LIBRARY OF CONGRESS
OCT 26 1891
COPYRIGHT DEPOSIT

THE AMERICAN

GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LV.—No. 17. Whole No. 855. | NEW YORK, MONDAY, OCTOBER 26, 1891. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y. AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—
The New York Meeting 577
Permanent Organization of the Chicago Gas Club 578
The Market for Gas Securities 578
*Gas Lighting and Ventilation 579
Electric Light in Holland 580
Steel Foundations 581
*The Steamloop 582
A Factor of Safety 585
Electric Transmission of Power 586
Special English Correspondence 586
Status of the Gas Industry—Gas and Electric Light at Cork—A Big Gasholder at Glasgow—The Amyl-Acetate Standard—Cheap Heating Gas—London Fogs.
ITEMS OF INTEREST FROM VARIOUS LOCALITIES 587
The Otto Gas Engine Secures the Highest Awards—Cheaper Gas for Wilmington, Del.—Annual Meeting, Troy, N. Y.—Cheaper Gas for Rockford, Ills.—The Cleveland (Ohio) Company Carries the Rate Argument to a Higher Court—And a Consumer Insists that the Company Shall Supply Gas at the Councilmanic Rate—New Plant of the Delaware Iron Works—Mr. Robert Albertson Goes to Rockford, Ills.—Peabody (Mass.) to go into the Electric Lighting Business—The New England Patent Gas Company——Death of Mr. Edward Hilliard—In the Hands of a Receiver—Mr. Taylor to Retain the Management of the Scott Properties—Hints from a Traveler—Suit Against the Atlanta (Ga.) Gas Company—And Many Other Items.
Asbestos Mining in Canada 589

THE NEW YORK MEETING.

As this is the season when the chestnut burr, in bursting compliance with the squeezing grip of the lowering temperature of mid-October, gives up its nut-brown complement of fruit, we may perhaps be forgiven for uttering anew the time-honored remark that all things come to those who wait; and so it was that the 19th annual meeting of the American Gas Light Association "came to pass." Doubt and uncertainty were for a time in the ascendancy. President Harbison had been prostrated by the burning torch of fever, just at the moment when the pressing duties of his office claimed him; Secretary Humphreys also shared the lot of those that sickness puts its dread seal upon—small room for wonder, then, that doubt and uncertainty had their innings; but not for long. The rank and file of our Associations are not of the shirking or shrinking order, wherefore willing subalterns laid out the field work and trained the guns. Captain White and Mr. A. C. Humphreys, backed up by an efficient local committee, all acting in admirable harmony, speedily put things in shape, and doubt and uncertainty gave way to conviction and assurance.

It was hoped that New York would witness a great gathering of the membership, and that such a result was to be was plainly foreshadowed at as early a date as the Monday preceding the eventful third Wednesday in October.

From North and East, from South and West, the advance guards came, and Tuesday hailed the appearance of the Chicago brigade, commanded in person by the jolliest and staunchest of brigadiers. The trip from the Windy City was made without a single break, and the daughters of the regiment had not occasion even to put a shears in court plaster. Following Chicago, was the Eastern contingent, and the Central States kept one busy noting the appearance of their squads of twos and threes. By ten o'clock of Tuesday evening the halls of the Gilsey, the Ashland, the Sturtevant, the Westminister—all of which houses are amply able to care for many without seeming to emphasize the presence of a number—were animated by the greetings of the representatives. Upper Canada fraternized with the Pacific Coast; Louisiana shook hands with Massachusetts; Ohio hobnobbed with Florida, and so it went. "Chief" Bradley, Chairman Beal, Secretary Weber and Capt. White, of the local committee, were on hand—here, there and everywhere, looking to the comfort of the incoming throngs, and it is not too much to here say that Bradley's tact and Beal's aptness for directing without seeming to point the way, were quietly and surely effective. A cool, bracing atmosphere, in delightful contrast to the somewhat dull and foggy weather conditions of the two preceding days, sent everyone to bed with the assurance that a good night's rest was to be their portion.

Early on Wednesday morning, the fraternal scenes of Tuesday night were re-enacted, and, when the hour set for the assembling of the delegates was marked by the dial, the center of activity was transferred to the Scottish Rite Hall. The sharp, cool autumn breeze of early morning had been tempered by the rays of as brilliant an October sun as it ever was one's fortune to enjoy. It would filter through the solemn toned panes of the gothic windows, filling the gloomy interior of what had been for over a quarter of a century the worshipping place of the Rutger's Presbyterian Congregation, but for the past four years given over to the work of the Consistory, with a mellow light that kept before the delegates their own mission in spreading illumination over their respective communities. First Vice-President White—handsome, trim and dignified—flanked by Acting-Secretary Humphreys—tall, spectacled and scholarly—called the meeting to order. It has been our good fortune to have been present at many Association meetings, but none other seemed to start in more impressively than this. Row after row of earnest faces, many crowned with the glory that time puts upon those who have heeded her mandates—the white locks that speak eloquently of experience; youngsters, too, beaming with health, vigor and hope—all were there, met for common cause, the advancement of their profession. Like a veteran, the Chairman at once went at the programme, and ere the members rightly knew it, the proceedings were underway.

Having despatched some preliminary routine business—which included the election of over 50 members, the largest number ever admitted at a single session in the history of the Association, the report of the Council, reports of special committees and election of officers—the Chairman explained that owing to the exigencies of the occasion, no set address could be read. He spoke most feelingly of the cause that occasioned the absence of their two chief executive officers, but gave hope that on the morrow President Harbison would be with them in person, if only for a few hours. He also imparted the cheering news that Secretary C. J. R. Humphreys would soon be in the active ranks again. His reference to the gaps in the membership caused by the hand of death was a beautiful testimonial to their memory and worth. In fact, he carried his speech so fluently that it may be said to well stand for the usual inaugural review. The Chairman, as representative of the Joint Committee on World's Fair, prior to the remarks just spoken about, also made a verbal report with respect to the Committee's attempt to secure adequate recognition for the gas industry at the World's Fair. He confirmed amply that which had been the general impression respecting the outcome of their efforts. To put it plainly, the Committee's plea received scant courtesy at the hands of those of the Fair's managers in charge of the lighting. They curtly said in effect that electricity was to have the field at Chicago in 1893 as far as they could favor it. That gas would only be employed where it could not be dispensed with. No wonder, then, the Committee asked to be discharged from further consideration of the matter, a request that was promptly acceded to by the Association. In our opinion, the Chicago Gas Light and Coke Company is not altogether free from blame in this matter. Its managers never made a move to secure recognition for the gas industry of their city—at least 75 per cent. of whatever gain would accrue to the industry at large by a display of gas lighting *per se* at the Exhibition would accrue to the Chicago Gas Company—and thus it would seem that if that Company did not take the initiative other gas companies should not feel cut up over it. A thing that has no value at home is not worth much abroad. However, to return to the meeting. So well had business been expedited that the closing session of the first day witnessed a successful attack on the paper list—the papers by Messrs. Nettleton and Clark, and that of Dr. Wilkinson, were disposed of, and a more interesting trio of papers, followed by complete and valuable discussions, it would be hard to find record—the result of close application to business and competent direction of the same. The officers chosen were :

President.—Wm. Henry White, New York.

Vice Presidents.—A. E. Boardman, Macon, Ga.; W. H. Pearson, Toronto, Canada; Walton Clark, Philadelphia, Pa.

Secretary and Treasurer.—A. B. Slater, Jr., Providence. R. I.

Council.—Jos. B. Crockett, San Francisco, Cal.; C. J. R. Humphreys, Lawrence, Mass.; John Young, Allegheny Pa.; Irvin Butterworth, Columbus, Ohio; C. H. Nettleton, Birmingham, Conn.; Jas. Somerville, Indianapolis, Ind.; A. W. Littleton, Quincy, Ills.; F. Egner, New York, N. Y.

The name of Mr. Slater was received in such a manner that evidently the members agreed in the belief that a worthy successor to Mr. Humphreys had been chosen.

Thursday was as wretched a specimen of weather as New York could possibly have been treated to. A cold, driving rain kept up all through the day, greatly curtailing the enjoyment of the lady visitors, extensive preparations having been made by the Committee for their visits to various points of interest. It could not be helped, however, and the disappointment was borne with good grace.

At noon of Thursday the appearance of President Harbison, who had been permitted by his physicians to make the journey to New York, was the signal for tumultuous applause. Thin and wan, he plainly showed that the struggle with the insidious disease that had beset him was prolonged and fierce, but nerve, nursing, and absolute rest gained the day. When the time for introducing the new board of officers was reached President Harbison arose, only to be again greeted with a welcome that we venture to assert brought with it more sustenance than any of the drugs that illness forced upon him.

This introduction of the officers was carried out with far greater impressiveness than is usual at our Association meetings. Perhaps Capt. White's response to the President's words of introduction was the very best of the many very good speeches that he has made. His words were full of that eloquence which appeals to friend or foe. Other responses by the incoming board were also filled with meaning betokening the future progress of the Association on still broader lines. These will in due time appear in the report, but we cannot forbear from remarking that those who heard Second Vice-President Pearson's speech will not agree that he was chosen to the office chiefly because of the fact that his fellow-members wished to honor Canada in his selection. Hardly so long and faithful service had far more to do with it. Mr. Clark's acceptance of the Third Vice-Presidency was spoken after the fashion of a manly man, and Mr. A. B. Slater, Jr., who has a keen appreciation of the duties of the Secretary's desk showed that he knew that labor awaited him, and that he proposed to compass it.

Having made a reference to some remarks leveled in the past at the dilatoriness and lack of action on the part of the joint committee on proposed gas exhibits at the World's Fair, President Harbison resigned the direction of the business of the meeting to Chairman White. As with the business of the first day, that of the second was carried through in good manner. The remaining papers were disposed of, and the discussions were not only more than ordinarily interesting, but also brought out many new speakers whose future contributions to the technique of the industry are bound to be of importance.

An exhibition of gas appliances was carried on in the basement of the Hall during Wednesday and Thursday, but owing to the scant time (only two days prior to the convention had it even been thought of) given to the exhibitors for preparation, it was not as successful as some others that were given at other times. The approaches to the show room were not inviting, and the inability to ventilate the place caused the heat to be almost unbearable. It attracted a great many visitors, however.

The regular business sessions having terminated, the next number on the programme was the banquet tendered the Association by the Gas Companies of New York city and vicinity. Covers were laid in the handsome main hall of the Manhattan Athletic Club's building, on Madison avenue and 45th street, and over 300 of the members and their guests participated in the festivities. The arrangements were perfection, and the dinner was served in faultless style. It was now that the Committee of Arrangements were at their best, and a carper indeed would he be who asked for better care and cheer—neither could have been excelled. The dining room was a picture—the only defect was that incandescent electric lighting was rather prominent, but that is neither here nor there. President-elect White acted as toastmaster, and that is equivalent to saying that a master was at it. President Harbison responded to the toast of the American Association, and it seemed to be injudicious on his part to so tax his strength—in fact before he could finish all that he desired to say he had to confess his weakness, and be assisted to his hotel—word from him this morning, (Friday) we are glad to say, is that he is better and resting easily.

The regular order came to a close at an early hour, and all voiced hearty thanks to their hosts. Chief Bradley, Mr. Beal and Mr. Weber were as spry as crickets. A feature of the attendance was the presence of Mr. O. Zollikoffer, of the Consolidated Company, who bore his years with the dignity of the hearty veteran that he is. As I write (11 A.M., Friday), the last number of the outing programme—the steamboat excursion—is "on," and although the weather is rather cool, it nevertheless is beautifully clear.

This preliminary account of the meeting is thus put together so that our readers may have some inkling in the current number of one of the most representative and valuable meetings ever held by the American Association. The next meeting is to be held in Boston, Mass.

PERMANENT ORGANIZATION, CHICAGO GAS CLUB.

On the 17th inst. the Chicago Gas Club elected permanent officers, at a meeting held at 115 Dearborn street. The attendance numbered 30, and 18 new names were added to the roll. The election resulted in the following choices : President, Mr. J. B. Howard ; Vice-President, Mr. Fred. Persons ; Secretary and Treasurer, Mr. Fred. H. Shelton. Messrs. Yuille, of Chicago, and Fitz, of Elgin, Ills., together with the officers, constitute the Executive Committee. Dinner was subsequently served at Becker's restaurant, Carl Bradley doing the honors, and, it is needless to add, with grace and liveliness. The first gathering of the Club was an unqualified success.

The Market for Gas Securities.

There was but little change in the gas share market, the tendency, however, being towards higher prices. The quotations tell the story.

MR. P. G. VAN WIE, so well known from his connection with the Van Wie Gas Stove Company, has purchased an interest in the Chicago Gas Stove Company, and will hereafter have entire charge of the Chicago Company's manufacturing and sales departments. Van's many friends will wish him success in his new venture, and will join in the hope that the clouds have permanently rolled by and over his territory.

Gas Lighting and Ventilation.

The London *Journal* notes that at a recent conference of the members of the Belgian Association of Gas Managers, M. Bandsept read a paper on the above subject, in which he described the system of ventilation by means of gas lighting which he has carried out in the rooms of the Association in Brussels. The following is an abstract translation of the paper.

The author commenced by remarking that one of the inconveniences frequently stated to attend the use of gas is the great quantity of heat generated by it in the places where it is consumed for illuminating purposes. Electricians, as is well known, never fail to magnify this defect. But the answer that can be promptly given to them when they bring forward this objection is that the evil is not irremediable, seeing that in the majority of cases it would be easy to carry out an installation of gas lighting by which the air would not be vitiated. More than this, gas could be made to play an essentially useful part, by being turned to account in improving the hygienic conditions. In this way one of the chief arguments used in support of electric lighting would be disposed of at a stroke, while gas would give one more forcible proof of its practical qualities. In fact, natural ventilation, which results from the difference in the density of the inside and the outside air, is attributable to atmospheric variations, and consequently can only conduce to uncertain effects. Aeration by means of open fires is not generally so efficacious as people try to make out, and in several respects it presents inconveniences. This leads to a preference for mechanical ventilation; and among the means to be employed for this purpose, the simultaneous application of the lighting and heating power of coal gas presents itself as one of the most rational. Recuperative lamps possess the great advantage of reducing, in a very notable degree, the deleterious action of coal gas, by converting into luminous rays the non-utilized heat of combustion. These lamps are consequently better fitted than any other appliances to perform the important part devolving upon gas in ventilation. The problem, thus regarded, is capable of solution in two ways, according to whether the object is to carry out a certain determined system of lighting, or the elimination of the vitiated air from a closed space wherein it is desired to maintain a given temperature.

The author went on to remark that the complete study of a system of ventilation actuated by the combustion of gas is a rather complex subject. It comprises the extent and distribution of the lighting; the volumes of gas and air necessary to produce the desired effect; the quantity of vitiated air to be conveyed away and of fresh air to be introduced; the distribution of the temperatures in the locality under consideration; the force and direction of the currents engendered by the entrance and exit of the air; and lastly, the radiation from the gas burners and lamps. The practice of ventilating by gas has not yet become very general. However, thanks to a rational application of the heat evolved, it is possible to ameliorate, in a large measure, the hygienic conditions under which we live. By means of high power lamps fitted up for ventilation, it is an easy matter to carry off the products of combustion; and the lighting conduces to a renewal of the air, and consequently to the rendering of the apartment salubrious. The lamps act first of all by means of the volume of air necessary for feeding them, and afterwards by that which is drawn along in the movement of the products of combustion. The effect of these two actions is proportionate to the consumption of gas; or, to be more exact, to the degree of temperature developed in the lamps. Vitiated air generally rises towards the ceiling, and it is from there that it must be removed, especially if the outside temperature is higher than that of the place to be ventilated. In this case also, care has to be taken to close the outlet orifices, which are made in the lower part of the apartment; for it is obvious that every well managed installation should help to carry off the vitiated air as well below as above. The fresh air, which, by preference, should be made to enter by special openings independent of the doors, ought not to flow at too high a speed, or at a temperature appreciably below that of the locality to be supplied; and, of course, the intakes should be protected from every deleterious emanation. They should necessarily be situated at a sufficient distance from the outlets. When the outer air is laden with smoke, it is well to take the precaution of filtering the inflowing current. The temperature which it is important to maintain in the interior of inhabited apartments varies according to the length of time they are occupied, and to the degree of activity of the ventilation. On an average, it should be from 16° to 20° C. (60° to 68° F.).

In order to adapt high power gas lamps to ventilation, the chimney has to be surrounded by a casing or sheath, whereby the vitiated air is drawn up and carried along by a current of air determined by the products of combustion. The bell by which the drawing operation is effected is surmounted by an exit pipe opening into the outer air or into a chimney. Two or more lamps may be connected in such a way as to turn their products into one common flue situated near the ceiling, and leading into a neighboring chimney or to the open air. The simplicity of the means to be employed in fixing ventilating lamps renders the work easy to anybody. Nevertheless many precautions have to be taken which practice alone can teach; and the neglect to observe them would, in certain cases, have for result to compromise the safety of the installation, and interfere with its proper action. Generally, the appearance of installations of this kind leaves little to be desired. In most cases the piping is completely concealed by false rafters, either in wood or in sheet iron, producing the effect of a chambered ceiling. In new buildings it will always be easy to turn to account, for the ornamentation of the rooms, the various conduits necessary for ventilation. Under these conditions, the more this elevated canalization is made to ramify in all directions, the more will the lighting and ventilating appliances become independent one of the other and their useful effect increased. As each of the lamps would be acting under its normal conditions, the slightly appreciable variations occurring in the working would be diminished by the gaseous mass in circulation in the collecting flue.

Various reasons make it impracticable for each lamp to be connected with a separate channel; but at all events it is desirable that a channel should serve for only a small number of lights. In any case, the exhaust pipes should be of suitable size, in order to ensure good ventilation. Their sectional area depends upon the speed set up at the average temperature of the mixture of smoke and air in the flues, as well as upon the natural draught of the chimney. It evidently augments with the volume of air which the lighting appliances should draw in. As the temperature of combustion is so much the greater in proportion to the height of the temperature at which the combustible is introduced, it follows that the lamps which are most recuperative are those which will also ventilate the most energetically. In high power lamps, the lost heat of the flame serves to raise to a high temperature the air which supports the combustion of the gas. With the types of the lamps employed for industrial purposes—those consuming 300, 450 or 600 liters (10, 14 and 21 cubic feet) of gas per hour—the waste gases are evolved at about 290°, 390° and 460° C., respectively.

The collecting chambers being generally of metal, their sides are liable to become heated to a sufficiently high degree to constitute a permanent danger of fire, if care is not taken to prevent them from coming in contact with the joists. The chambers are isolated either by locating them at a sufficient distance from the ceiling, or by interposing between the latter and the hot metallic walls of the chambers some substance impervious to heat, or having the property of diffusing it. The former method is only applicable when the apartments to be ventilated are of considerable height. Consequently, in the majority of cases, artificial means of isolation—by the use of pulverized refractory materials, asbestos, etc.—have to be resorted to. The radiation of heat may likewise be intercepted or dispersed by superposing screens in the space between the hot surfaces and the ceiling. The screens are arranged in such a manner as to impart by convection, to the air surrounding them, the heat which they themselves receive. By contriving, perpendicularly to the flue, a chamber open at its two extremities into the wall, a current of air is obtained sufficiently active to lower the temperature of the entire system. These screens will act with the more energy in proportion to the speed of the induced currents, and the force with which they strike the sides of the plates intercepting the rays of heat.

The author then proceeded to describe installations of high-power lamps of the "Gaso-Multiplex" type, in which the principles enunciated above had been applied. They are shown in the accompanying illustrations.

Figs. 1 and 2 are side and end views of the installation at the establishment of the Belgian Association of Gas Managers in Brussels. The collecting pipe C is placed inside a false joist P, to which the lamp is fixed. The air circulating between the pipe and the joist acts as an insulator. By excess of precaution, a layer of asbestos is put above each lamp, in those places which are more directly exposed to the action of heat. Besides, the joists being in this case ironwork and masonry, there was all the greater necessity to reduce the depth of the beams, as the ceiling of the room was not very high. This installation, with its ornamental lamps concealing the air-inlets and the ventilators, presented a most satisfactory appearance. Figs. 3 and 4 show ventilating lamps fitted with metallic plates, the object of which is to intercept the radiated heat, which afterwards inflects under the impulse of the interrupted current set up, immediately below the critical point, in the joists P_1 P_2. It has been shown that in order to utilize high power burners for ventilating purposes, it is sufficient to surround the chimney

with a sheath or casing, so that the products of combustion may pass to the center, and thus form a draught for the vitiated air which is drawn into the stream of hot gases. But the way in which the liberation of the smoke-laden fumes in the collecting flue is operated is not an unimportant matter. It has a very manifest influence, not only upon the regularity of the aeration, but also upon the steadiness of the light. In order to connect a lamp with the service-pipe, the shortest way would

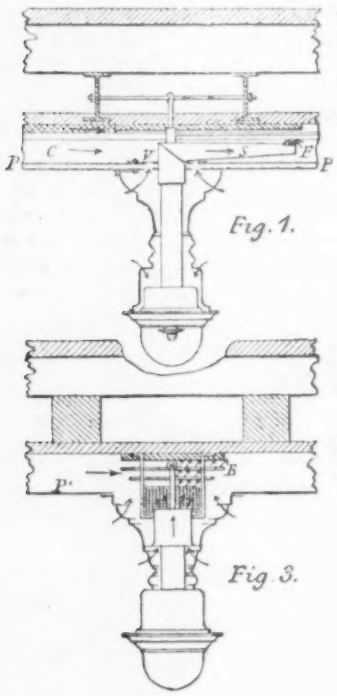


Fig. 1.

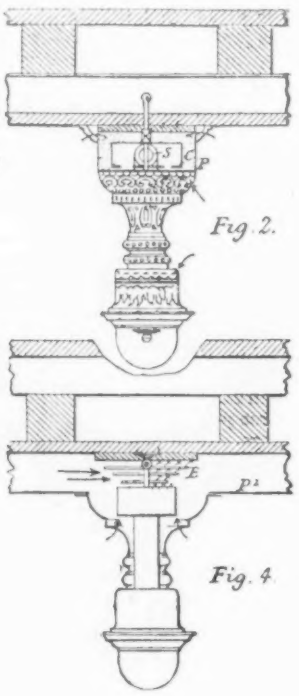


Fig. 2.

Fig. 3.

Fig. 4

be to separate the upper part of its chimney by a metallic casing, conical at the base, and the top abutting upon the canalization, as shown in Fig. 3. This arrangement, however, does not give good results; for when the lamp is near a chimney, it is difficult to protect it from the return currents of air, the effect of which is to make the flame unsteady and cause variations in the rate at which air is drawn in through the periphery. When, with the object of counteracting these effects, an attempt is made to increase the draught, the luminous surface of the flame vibrates under the tension resulting from the conjunction of the induced currents immediately above the inductor jet. One is then led to agitate the gases in the interior of the flue by the use of a conical adjustment, as is done with injectors. This arrangement was decided upon by M. Aerts, after having a number of trials carried out in Brussels; and, as shown in Fig. 1, it was also adopted for the installation at the rooms of the Association.

The chimney of the lamp is surmounted by an elbow piece *S*, which is prolonged more or less into the flue, and decreases in diameter towards its extremity. By closing this conical pipe by means of a flap *F*, manipulated from the outside of the beam *P*, the formation of deposits of the products of combustion in the interior of the lamp, when the light has been extinguished, is prevented. In this case also, care must be taken to cover the air-inlet *V*, as otherwise a passage would be afforded to the mixture of in-drawn air and the products of combustion given off by the second lamp, supposing this to remain alight. From that time the lamp is completely isolated from the flue, and cannot possibly cause any disturbance in the action of the other parts of the installation contributing to the lighting. The air-inlet *V* is worked by an articulated lever, one of the arms of which extends beyond the cap, within reach of the hand for regulating purposes. The flue *C*, in which are collected the smoke-gases and the aspirated air, usually leads into a chimney.

In the installation put up for the Association, a definite quantity of light had to be furnished; that is to say, each room admitted of an amount of lighting which it would have been abnormal to appreciably exceed. In the room used for the exhibition of gas-heating appliances —30 ft. by 14 ft. and 13 ft. high—two No. 3 lamps of the "Gaso-Multiplex" type were placed, each giving the light of 13.5 carcels (128 candles) with a consumption of 450 litres (15.9 cubic feet) of gas per hour. These lamps, suspended at a distance of 2 ft. 9 in. from the ceiling, were so fixed as to allow a space of 9 feet between them and the wall. Under these conditions, admitting that the lighting plane was at a distance of 3 ft. 3 in. from the floor, the lights would be situated 7 feet from the plane. In the four corners of the apartment, the luminous intensity would be at the minimum; while its maximum would necessarily be immediately beneath the lamps. By this system of lighting, nearly 5000 cubic feet of fresh air per hour were drawn from without, and made immediately available for respiration. This bulk of air, added to that entering by the door, was ample for sufficiently changing the atmosphere. It has been found that with the temperature outside varying from 3° to 4° C., the heat within has only increased 2° C.—from 18° to 20° C. (64° to 68° F.)—after four hours' lighting.

As to the useful effect of ventilation by means of high-power lamps, it follows, from a comparison of the heat units in action during the movement of the available fresh air with those resulting directly from the combustion of the gas, that one cubic metre (35.3 cubic feet) of gas completely burned gives off 5400 calories. The calorific capacity of the air, brought to its volume, is 0.312. It therefore follows that the 900 litres (31.8 cubic feet) of gas consumed per hour for the lighting produces 4760 calories. On the other hand, the 137 cubic metres of air introduced absorbs ($137 \times 0.312 \times 52$) 2220 calories. The yield is consequently about 45 per cent.—a very good result indeed. These figures show what great effects are obtained from illuminating gas by applying high-power lamps to ventilation. Already the increase in luminosity with these appliances is equal to an economy of nearly 50 per cent. in the consumption required by lamps with ordinary burners; and now to this advantage is added a rational utilization of a quantity of heat which up to the present time has been lost. This bears upon a question of hygiene of absolutely primary importance, which has for a long time been awaiting solution. In this way gas reveals once more the fact that not only does it lend itself to the solution of essentially practical problems, but does so under the most advantageous commercial conditions.

Electric Light in Holland.

London *Electrician*, writing about this, calls attention to the circumstance that in a country where so curious a mixture of imperturability and enterprise, of thrift and luxury, is to be found, it seems to be a mere chance whether electric light will spread rapidly or struggle ineffectually. It happens that what little electrical work there is has been put down by Germans, and though it is spreading on its own merits, it is not likely to be taken up so well as if some Dutch engineers could be found to turn their attention from canal cutting and dyke building. Numerous factories are provided with their own electric light plants here, as all over the world; but, as far as we are aware, there are only two public supply stations, the one at the busy capital, Amsterdam, and the other at the fashionable residence of the Court at the Hague.

On a recent occasion we took the opportunity of visiting these two stations, tracking them down in each case by the chimney shafts and their exhalations; for the Dutchman is justly proud of the picturesqueness of his streets, and allows no overhead wires. With praiseworthy impartiality Holland has adopted alternate currents in one station and low pressure with batteries at the other, and as far as the light is concerned, both glow lamps and arcs are thoroughly first class, the former being well up to color, the latter steady and silent, both giving general satisfaction, and not known to fail.

At the Hague we found the central station a substantial building, consisting of a commodious engine room and "kettle house," surrounded and overlooked by a glazed corridor communicating with the various offices of the supply company. The whole of the plant, from the dynamo to the lamps themselves, including the mains, is supplied by, and is the design of Messrs. Siemens and Halske, who are represented by the chief engineer, N. J. Singels. A pair of horizontal engines had been at work, but are now dismantled, and are being moved to allow for extension of the plant, on account of the increasing demand for light. The three-wire low-pressure system with batteries is employed, and the load last month was equivalent to rather more than 3,000 16-candle lamps. The engines are of an inverted marine type, and drive two dynamos, one at either end of the shaft, the driving of course being direct. There are two of these sets, and there is plenty of room for two or three more. They are of the inside pole, outside commutator pattern. The stationary magnets are like those of the Jablochkoff dynamo; and the armature, wound Grammering fashion, with bar conductors, is overhung. The outer surface of the armature acts as a commutator; and although the machine appears to be very expensive to build it must be admitted that the trouble of attaching the sections of a separate commutator is thus avoided. It was pointed out that the centrifugal force in such an armature is balanced by the pull of the field magnets; but

the only advantage to be seen in this type of machine is the reduction of angular speed of the armature and shaft, at the cost of considerable mechanical stress and very large peripheral speed of commutator. It is rather remarkable that while the English firm of Siemens Bros. has put down a set of dynamos at the Naval Exhibition of the largest and most substantial character, and of a design and workmanship that cannot fail to please the eye of an English engineer, their German allies should deliberately build such strange machines. There is no reason why the efficiency should not be excellent, and the only points about which we are inclined to be skeptical are the cost and the durability.

Only a small battery capacity is provided at the Hague station, and it is employed in much the same way as at Kensington and Knightsbridge. An all day supply is provided, all the private houses and smaller customers being charged by meter, while the hotels and large establishments are charged by contract. A large switch-board, placed in a gallery overlooking the engine room, controls the various feeders and mains, voltmeters with pilot wires from the ends of the feeders and ammeters being provided while an attendent controls the pressure by means of resistances. In the *ketel-huis* large locomotive boilers are used and, the remaining space being limited, a water tube boiler is being put down. The economy of this station appears to be remarkable, but the figures which we saw cannot be compared directly with those of our London stations, though we hope that the Chamber of Commerce scheme of gathering statistics will enable a just comparison, in such a case as this, to be made. Load diagrams are taken every day, and among the various analyses which are made is one which gives the "ampere hours per kilogramme" of coal. This appears to vary from 2.8 to 3. There being, say, 110 volts, this gives 308 to 330 watts for 2.2 lbs. or 5.33 to 4.97 lbs. per electric horse power. Siemens' armored cable is used, many of the feeders being concentric conductors.

At Amsterdam a beginning was made in the center of a large block of houses in the business part of the city, and overhead wires were run to various shops and hotels. The light being appreciated, more plant was put down, and permission was granted for running underground conductors. Alternating currents are used, one dynamo running direct on the mains, and the other on alternators. The high pressure service is at 2,000 volts, and is transformed to 72 volts for the glow lamps and to 36 volts for the arcs. The dynamos are of Ganz's make, and resemble the Siemens continuous current dynamos at The Hague, in having overhung ring armatures with fixed internal magnets, and are direct driven by horizontal engines. The space in the engine room is very limited, and the supply company hopes to remove shortly to larger premises. The underground conductors are made by Felten & Guilleaume, the larger ones being concentric; they are lead covered, and are laid in wooden troughs, filled in with asphalt and covered with stone flags. The supply is not maintained all day, but the whole of it is charged by meter, considerable abatement being made to large consumers. Frager and Aron meters are used, and a meter of Ganz & Co. made by the Helios company. The transformers, arc lamps, and many of the accessories are of Ganz's design, but manufactured by the Helios company.

The price charged at Amsterdam is 8d. per 1,000 watt hours; and lamps are to be bought, having a life of 1,000 hours, and an efficiency of 3½ watts per candle for 1s. 8d. to 2s. The price of current compares well with that which is charged in London, when it is remembered that while the gulden is worth 1s. 8d., it only goes as far as a shilling in most purchases; and the price of 8d. may, for practical comparison, be reduced to less than 5d. It is a pleasure to find such good results, and that the work is well and carefully carried out, with no unsightly temporary makeshifts.

Steel Foundations.

By Mr. C. T. Purdy, C.E., in *Engineering News*.

The prairie soil underlying the city of Chicago is unfavorable to the construction of heavy foundations. The character of the strata changes materially in short distances. In general, however, there are 6 to 12 feet of loam and quicksand, then a layer of clay, which is hard and firm in some places, but in others so soft and wet that it may be readily taken out with a spade. In the business section of the city, where all the great business blocks are located, the clay, often mixed with strata of quicksand, reaches down from 40 to 80 feet to a limestone foundation. Generally a few feet down the clay grows softer and wetter. If any of it becomes solid and hard, or there are any hard-pan layers within the reach of ordinary piles, there seems to be no indication that they are uniform, or at all to be relied upon. Until recently, heavy foundations were commonly built of stone and concrete resting on the clay. In later years, however, this method has not given satisfactory results. The demand for all the space in the basements of great buildings has yearly grown more urgent. Either the bed of the foundations must be lowered, the foundation itself must be made thinner, or some entirely different method must be employed. The first of these alternatives has been very generally ruled out, because it has been demonstrated very clearly that the less the clay stratum is broken, the more uniform and satisfactory is the settlement of the building. Other methods have been tried repeatedly, piles have been driven, and sometimes timberwork has been combined with masonry and concrete, but the results thus obtained have also been generally unsatisfactory. As an example, the Cook County Court-house, which was built on piles, is reported to have settled over a foot and very unevenly. There are still some, however, who advocate their use. If the piles could be driven deep enough to rest upon some hard bottom, they might give us a permanent, unyielding foundation; but judging by results so far obtained, the method is not nearly as reliable as the direct clay bearing.

The drift of practice has been to make the foundation thinner with the use of iron, spreading out on the top of the clay without materially breaking it. At first it was only in a half hearted way. Many old rails were used, and they were sometimes laid very unscientifically. But the practice has steadily improved. New rolled rails and heavy beams are now employed, and they are as carefully calculated for their work as any other iron in a building. This evolution has produced an entirely new type of foundations—a substitute for heavy masonry and huge blocks of concrete. Let us see how fully it has met the problem,

The site of the building now being constructed by the Women's Christian Temperance Union, was previously intended for another structure, all the foundations of which were put in place some years ago. These were made of great piles of masonry, one for each column, all underlaid with a bed of concrete resting on the clay stratum about 10 feet below the street grade. This great quantity of stone so cut up the space below the street level that nothing was left available for basement use. There are now acres of buildings in the very heart of Chicago without any basement, and on this very account. In this case all the masonry has been removed, and new steel foundations have been placed on the old bed of concrete so well designed that all the basement space is available. This is the great difference between the two methods which everyone first notices, and which, of course, tells most from the financial standpoint.

In the time required for building, the iron foundation has a great advantage, at least in Chicago. If rails are used, the rails can be placed on the ground in two or three days, and when all the material is at hand and excavations completed, the whole foundation can be put in place in a few hours. This is oftentimes a very great advantage, and alone a sufficient consideration for the employment of this type of foundation. The cost of iron foundations varies exceedingly, depending principally upon prices of material, the ingenuity of the engineer and the familiarity of the workmen with that sort of work. In general, the cost of stone foundations will figure somewhat under that of iron, but compared with the cost of foundation per square foot of renting area, which is the proper way of doing, this difference will be eliminated.

It often occurs that heavy column loads come close to some old building or to another man's lot, so that it is impossible to spread out alike on every side. In such a case as this, the area between this and some other column can be spanned with steel beams, making a compound foundation and utilizing an area that could not be used at all with masonry. Oftentimes in this way a foundation is made with two loads—one on each extreme end.

The clay loads most generally used throughout the business center of Chicago vary from 1½ to 2 tons per square foot, the tendency being for the former rather than the latter. With this load the structure will settle from 3 to 5 inches, and this is usually provided for by reckoning everything that much too high at the start. Settlement comes slowly, but none the less surely. It comes in proportion to dead loads, and is dependent in some measure upon the perimeters. The whole subject presents a most interesting field for study, and one in which there is much to be learned. The judgment of practical builders who have the best opportunity for observation confirms the theory that clay areas should be proportioned to dead loads only. Where live loads are figured into clay loads for interior columns and exterior walls, the walls invariably settle the most. The reason will be found in the fact that the live load is a greater per cent. on the whole load on the columns than it is of the load on the walls. The difference in length of perimeter for wall and column foundations must also have some effect, and a similar one. In most buildings it is desirable to count a fraction of the live load in the

total load on the columns, and consistency requires that whatever load is placed on a basement column should also be put on all the iron under the basement column. On this account it happens that while the area on the clay is calculated for dead load only, the beams in the foundation must sometimes be calculated for some live loads, and iron loads and clay loads must be kept separate and distinct. In general, the center of gravity of the load should coincide with the center of gravity of the clay area covered. In compound foundations this sometimes becomes complicated.

The concrete used is made of the best Portland cement, usually one part with four parts of crushed stone and two parts of coarse sand. Steel rails weighing 75 pounds per yard are mostly used where beams are not required. Seconds are found to answer quite as well as the first quality, and the chances are that for the length required they will be quite as good as the best, and if any flaw does exist the chances are few that it will come where the maximum bending moment occurs. In ordinary foundations they are more economical than beams. More iron is required, but the rails can be bought for about one half what the beams cost, thus more than covering the difference in weight. It is easier to place the concrete when rails are employed, and the webs are always thick, two other good points in favor of the rail. If heavy loads must be carried with a few pieces, as is often the case in the top course immediately under the column, heavy beams are a necessity. This is also often the case where long spans are required. The sizes generally used are 10, 12, 15 and 20 inch. There is no advantage in having the iron in direct compression, and only that part projecting is strained to its usefulness as a beam. Therefore it follows that the place for beams is at the top of the pile, and that the larger the proportion of iron uncovered the greater the economy of the structure.

In designing foundations the engineer first decides on the general arrangements to be used, the sections to be generally employed, unit strains, etc., all of which is dependent in a great measure upon his judgment and experience. This done, each foundation is treated on its own merits and each course of iron is separately calculated. In putting these foundations into position, the workmen first make a plank frame the same size as the concrete bed and place it carefully into position, making the top of it, with the use of a "Y" level, the exact height which the top of the concrete is expected to be. After this is filled another frame is arranged for the next course, and so on to the end. The rails for each course are spaced equally. The concrete is carefully tamped between, completely embedding the iron, and as soon as one course is completed the next one can be begun. After all this is done the boxes are taken away and the whole is carefully plastered with Portland cement mortar, so that at no place is the iron exposed. It seems as if these steel foundations might be used in other places, where bed rock cannot be had to rest loads upon, and where real estate is very valuable; though perhaps it would be difficult to find another place where they so perfectly fit the need as in Chicago. They are peculiarly well adapted to compound foundations, where the position of loads with reference to each other is bad, and the areas which the foundations can cover are limited. This need is very liable to occur in any large building—a tower between walls, a heavy chimney stack, or a badly arranged cluster of columns where it is almost impossible at best to distribute the loads so that they shall bear evenly upon the soil. In such places, if the load is not distributed, there will come an unequal settlement, and the bane of foundations is not that they settle, but that they settle unequally. Oftentimes in the arrangement of machinery it becomes necessary to build great pits almost adjacent to the bearing of heavy loads, and where the cutting of the masonry almost destroys the proper distribution of the load over the area expected to carry it. Here again the use of beams in conjunction with the masonry may be to the great advantage of the structure. Indeed, whenever the proper distribution of loads becomes difficult, iron may be made a valuable adjunct to the masonry.

The question of the durability of iron imbedded in concrete can only be definitely answered by time itself. So far, wherever iron has been taken out, it has been found well preserved. Chicago architects and builders are showing their faith in it by constant use, though wiseacres still shake their heads and prophesy that some day the rail will become a streak of yielding sand.

At the little village of Wellsburg, N. Y., six miles below Elmira, on the Erie road, gas has been discovered issuing from a well which was originally put down to secure good water. A stream of gas was flowing from the pipe sunk in the ground which an expert says would illuminate the whole county (?) The citizens of the village are enthusiastic.

The Steamloop.

[A lecture delivered before the Franklin Institute, by Mr. Walter C. Kerr.]

When your Secretary honored me with an invitation to address you, he suggested the acceptability of remarks on centralization of power for distribution—electrically, hydraulically, pneumatically, or any way—over large areas, etc. I considered this proposition only to conclude that it was a little broad for my caliber, for I think my personal inclination in choice of subjects may have been bored out rather small originally, and possibly has been "bushed down" since. At any rate, I would regard it as taking an unfair advantage to discuss ways and means I never tried, to quote authorities I never knew, to explain what is done abroad, where I have never been, and what is going to be done in a future of which I am not the prophet. Therefore, I have selected a subject so simple that it can become for an hour a personal matter between ourselves and the blackboard. Novelty is its chief claim for attention, but in it there is, perhaps, enough to be learned concerning new applications of old laws to repay the time spent, enough by way of peculiar phenomena to excite admiration, and possibly—at first sight—a little that seems paradoxical.

The steamloop is generally called an ingenious device, and if so, the ingenuity certainly appears at once in the name, "steamloop," a name which, though almost meaningless, seems very consistent with its simplicity. The name has the further merit of not portraying any of its functions or peculiarities, and hence cannot be an embarrassing restraint, as is so frequently the case with names attached to mechanical apparatus.

That so simple an application of nature's laws as is involved in the steamloop should not have been turned to useful effect earlier is, at first thought, strange, but as one looks deeper into the subject, the reasons become more apparent. While no engineer is unfamiliar with the phenomena on which it depends, it has been interesting to note that even those best informed in practical steam engineering or theoretical research in thermo dynamic science, seldom understand its action on first acquaintance, though they soon recognize in it a new combination of functions.

Its mission is the simple and useful one of returning water of condensation to steam boilers. Its chief characteristics are that its action is continuous, rapid and positive, and that it is a closed system operating under widely varying conditions, without valves or adjustments. Its construction is simply that of ordinary piping.

The principles on which its action depends are as follows:

Difference of pressure may be balanced by a water column.

Vapors or liquids tend to flow to the point of lowest pressure.

Rate of flow depends on difference of pressure and mass.

Decrease of static pressure in a steam pipe or chamber is proportional to rate of condensation.

In a steam current water will be carried or swept along rapidly by friction.

To these simple statements there will probably be no dissent. We have all used them in many ways, and some of them have disagreeably used us in a manner quite unwelcome. But it remained for the steamloop to collect a few of these erratic agents and from them create a useful system, combining the certainty of flow due to difference of pressure, with the quiet uniformity with which steam condenses, and with the force we see uselessly expended in the hammering of our steam heating apparatus.

It will be evident that the steamloop, therefore, contains no mysterious factors, even though, like the steam injector, it has been called a paradox.

We have here a working model (see Fig. 1), the steam pipe passing from the boiler to a separator near the engine, which separates the water of condensation and entrainment from the steam. The drip from the separator is below the boiler, and evidently were a pipe run from this drip outlet directly to the boiler, we would not expect the water to return up hill. Moreover, the pressure in the boiler is (say) 100 pounds, while in the separator it is only 95 pounds, due to the decrease in pressure in the steam pipe by reason of which the steam flows to the engine. Thus the water must not only flow up hill to the boiler, but also must overcome the difference in pressure. The device to return it must perform work, and in so doing heat must be lost. The loop, therefore, may be considered as a peculiar motor doing work, the heat expended being radiation from the upper or horizontal portion.

We are now prepared to examine its mechanical operation, which is best done with the model in action. The form of separator is immaterial, there being many kinds differing more or less in construction and efficiency. The one in model is simply an elbow turned down into the

body of the device (see Fig. 2), throwing the steam against a perforated plate above which the dry steam is removed by a pipe leading to engine, while the water collects below.

From the separator drain leads the pipe called the "riser," which at a suitable height empties into the "horizontal." This leads to the "drop-leg," connecting to the boiler anywhere under the water line. The riser, horizontal and drop-leg form the loop, and usually consist of pipes varying in size from three-fourths inch to 2 inches, and are wholly free

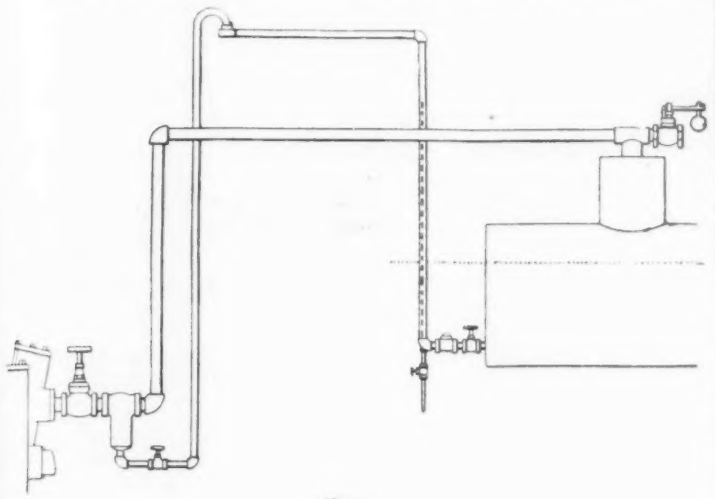


FIG. 1.

from valves, the loop being simply an open pipe giving free communication from separator to boiler. (For convenience stop and check valves are inserted, but they take no part in the loop's action.)

Suppose steam is passing, engine running and separator collecting water. The pressure of 95 pounds at the separator extends (with even further reduction) back through the loop, but in the drop leg meets a column of water (indicated by the heavy broken line), which has risen from the boiler, where the pressure is 100 pounds, to a height of about 10 feet. That is to the hydrostatic head equivalent to the 5 pounds difference in pressure. Thus the system is placed in equilibrium.

Now, the steam in the horizontal condenses slightly, lowering the pressure to 94 pounds, and the column in drop-leg rises 2 feet to balance it, but meanwhile the riser contains a column of mixed vapor, spray and water, which also tends to rise to supply the horizontal as its steam condenses, and being lighter than the solid water of the drop-leg, it rises much faster. If the contents of the riser have a specific gravity of only .1 that of the water in the drop-leg, the rise will be 10 times as rapid, and when the drop-leg column rises 1 foot, the riser column will lift 10 feet. By this process the riser will empty its contents into the horizontal, whence there is a free run to the drop-leg and thence into the boiler. In brief, the above may be summed into the statement that a decrease of pressure in the horizontal produces similar effects on contents of riser and drop-leg, but in degree inversely proportional to their densities. When the condensation in horizontal is maintained at a constant rate sufficient to give the necessary difference in pressure, the drop-leg column reaches a height corresponding to this constant difference, and rises no further. Thus, the loop is in full action, and will maintain circulation so long as steam is on the system, and the differences of pressure and quantities of water are within the range for which the loop is constructed.

The above may be termed the rational explanation, but for simplicity we have omitted to include some of the features which are of importance in the loop's utility and which will appear later in our consideration of the subject.

"Solid" Water vs. Spray.—In the model the water sometimes appears as a film along the sides of pipes, or as spray, and often as slugs rising quickly and passing over. We cannot definitely state whether slugs form in practice in full size pipes, but their existence is doubtful except when the separator is partly flooded by boiler primage. In the model the pipes are so small that cohesion and capillary attraction are sufficient to account for the existence of the slugs. The resistance of small pipes causes comparatively slow velocity, and the slugs are readily seen. In the full sized apparatus, however, the velocity is very great, so that even in glass sections a slug's passage would scarcely be discernible. Observations in this line indicate absence of slugs and confirm the belief that the water (other than spray) is carried chiefly by friction of steam current along the sides of pipes, and at a velocity so great that the sweep is distinctly audible when much water is moving. No water should accumulate in the separator, as it is the mission of the loop to remove it before it assembles into a liquid mass. It is here that the constant and vigorous action is of great practical utility, enabling the loop to act as a preventive of accumulation rather than a device for removing water after it has accumulated. The separator evidently must be of such form as to give the sweep towards and through the loop better opportunity to pick up the entrained water than is afforded the current sweeping toward the engine, pump or steam-using device. It is interesting to know that experiments on very large separators, as large as 5 feet by 12 feet, not discharging their contents, show that if water be allowed to accumulate to a certain height, no further rise will occur, even though much moisture be present, in the steam, showing that the steam sweeping through carries the water with it, unless that already deposited be drained away. Thus a separator to properly perform its function of drying steam must be empty, while obviously to stop and hold primage, its volume must not be impaired by periodic accumulations. Thus "solid" water in bulk is to be avoided. Condensation and entrainment should be retained and returned as spray or films, while primage should be broken up into particles or masses small as possible and instantly returned before a cumulative effect causes damage. In performing these functions the steamloop offers a new process in the apparently humble mission it serves.

That separators alone do not generally separate all the moisture from the steam is quite clearly shown by the fact that a loop will often return more water when the throttle is closed and the engine is idle, since the separator must then stop all moisture and the loop return it. With engine running, some moisture will always be carried over, the amount of course depending upon the efficiency of separator. Experiments on this feature are difficult because of the interference due to varying amounts of condensation, entrainment and primage, on all of which the draft of steam may have more or less effect.

Limitations.—Generally speaking, the limits within which the steam-loop is applicable are very wide, for the principle applies quite as well to great as to small differences of pressure. Similarly, an enormous quantity of water may be handled quite as easy as a small amount. The action will continue reliably through long pipes, overhead or underground. Water may be lifted from levels far below the boilers. The use to which the steam may be applied after the loop and separator have dried it, of course has no effect upon the loop system. Whatever steam is so used that it condenses rapidly, as in dryers, steam heating systems,

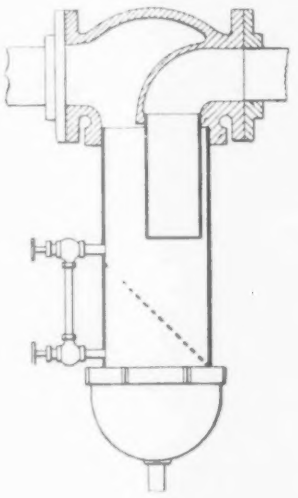


FIG. 2.

jackets, steam kettles, etc., the loop can be applied to the return of this water of condensation the same as from an ordinary separator, and that, too, against any difference of pressure.

The above statements are made to illustrate how thoroughly and completely the loop can be applied to a wide range of conditions, but when we come down to the practical application, and say how far is it expedient to apply it, the field contracts somewhat.

To take up the different limiting conditions, and comment upon their degree, will show most clearly the practical range through which the loop may be made a commercial device.

Difference of Pressure.—The loop's application in this regard is limited most often by the head room for its erection. If the pressure in a separator, dryer, or return from a steam heating system be 10 pounds below the boiler, and a loop about 30 feet high is necessary to make the return, it is evident that a difference of 50 pounds in pressure would

require a loop about 150 feet high, and the riser, drop-leg and large portion of the horizontal being well covered with non-conductor, such a loop would operate efficiently, but generally speaking, a line of small pipe of that height would seldom be convenient, inasmuch as it would require some peculiar structure to hold it, or possibly, might need to be erected on the side of a smokestack. In high city buildings such a loop

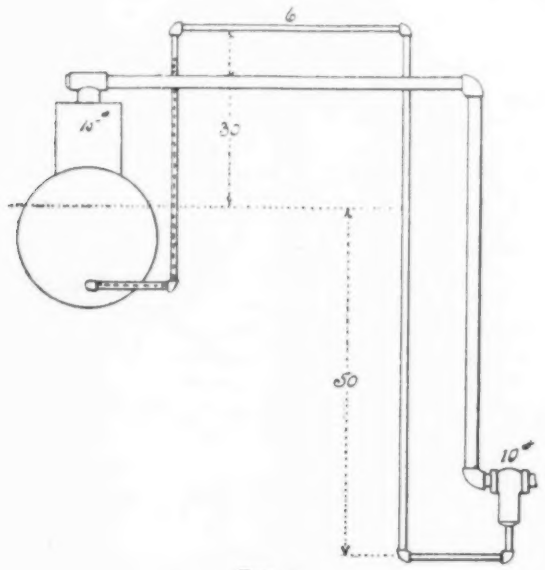


FIG. 3.

may be practicable, where convenient air shafts allow easy support, but in ordinary manufacturing plants it would seldom be constructed.

While speaking of difference of pressure, attention should be called to the fact that the absolute pressure is of no importance, as a loop will work quite as well under low pressure as high. Its construction and operation recognize only the difference of pressure. A special case occurs, however, where the difference of pressure is very large compared with the lowest pressure in a system. For instance, if a boiler carries 25 pounds of steam, and at the end of a series of heating or drying coils the pressure is 1 pound, then with a loop about 100 feet high it would be evident that if the condensation in the horizontal were performed as to even produce a perfect vacuum, the water column in

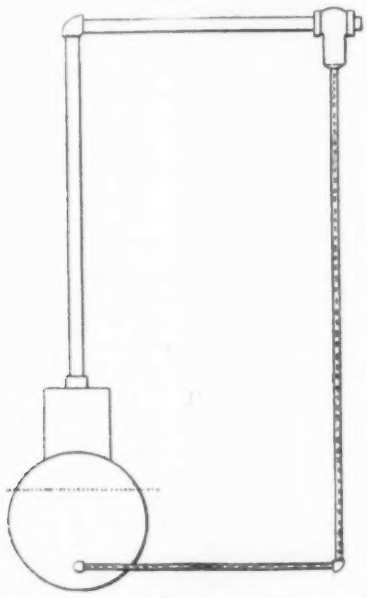


FIG. 4.

drop-leg would stand about 80 feet high, but it is doubtful whether the pressure of 1 pound at foot of riser plus the 14.7 pounds due to vacuum would be sufficient to force the contents of riser up 100 feet and into the horizontal. It certainly would not be sufficient if there were considerable quantity of water to be handled, thus causing a high specific gravity of riser contents. Such case, however, is so seldom met in practical loop application, that it scarcely need be considered a limiting condition.

Roughly speaking, the differences of 10 to 15 pounds are the largest experienced in good practice, and the loop can generally be conveniently erected to operate against such differences; and where excesive discrepancies in pressure are observed, it is usually very desirable to make such changes as will diminish differences, they being usually due

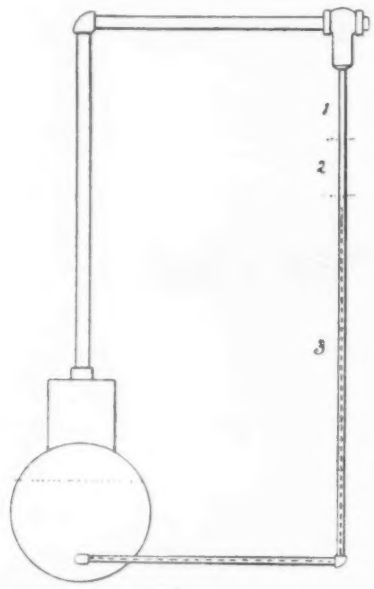


FIG. 5.

to faulty piping. While, therefore, excessive difference of pressure is practically a limiting condition to steamloop practice, it is not found to be an annoying interference.

Distance of Foot Riser Below Water Level of Boiler.—Since the system is placed in equilibrium by the drop-leg column, and this starts from the boiler, no account need be taken of the distance the riser may extend below water level in the boiler; that is, the engine, separator, or drying apparatus may be anywhere below with no effect upon the loop's action except the additional work imposed. This would, however, be a limiting condition when the riser column became so long that the pressure at its lower end is insufficient to lift the total weight of mixture into the horizontal. For instance, if the loop is working under 5 pounds difference, from 15 pounds to 10 pounds (see Fig. 3), and if the riser is so charged with water that the specific gravity is, say, 0.1, then when the horizontal further reduces the pressure to, say, 6 pounds, there would be a total forcing pressure up the riser of 4 pounds, which would support a water column 8 feet high, or a column one-tenth as heavy 80 feet high. The horizontal in this case would stand about 30 feet above boiler water; hence the foot of riser can extend about 50 feet below boiler. Similar figures for 80 pounds boiler pressure, with 75 pounds at engine and drop of 10 pounds in horizontal, would allow riser to run about 150 feet below boiler level. The above considers only a static

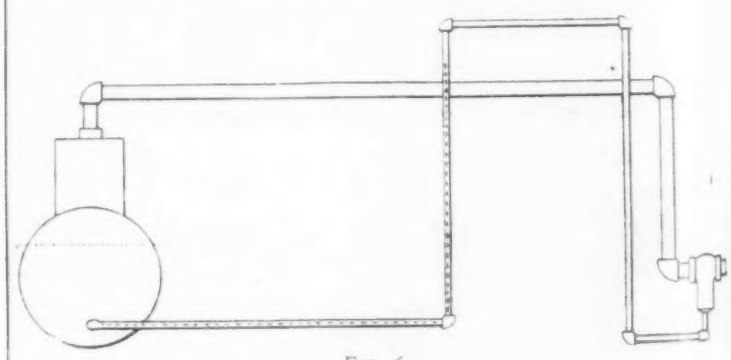


FIG. 6.

column, but if we allow for the sweeping action of the current ascending the riser, the allowable distance of riser foot below boiler will be much increased.

Distance of Foot of Riser Above Boiler.—Evidently the foot of riser can be elevated to any required extent; but there will be a height, depending upon difference of pressure, at which the true functions of the loop may seem to become superfluous. Consider the case where the drain is just at a height above boiler water equal to the hydrostatic head due to

the difference of pressure (see Fig. 4). Then, with no riser in the system, water collecting in the separator will run directly down a pipe, similar to a drop-leg, into the boiler. This water must collect in ordinary liquid state and exert gravity pressure before the column can move. The velocity of its exit depends wholly on the amount that has collected. Should the difference of pressure increase slightly, accumulation is necessary to cause drainage. This is simply a gravity system. It has no current carrying the water swiftly from separator and over a hill to a point of safety on the top of a water column on the other side, which may rise and fall from time to time without affecting the flow from the point that is to be drained. A gravity system is a water pipe sufficiently high to overcome a difference of pressure. A steamloop may be called a gravity system from the boiler to the top of water column in drop-leg, but a steamloop essentially is a device extending above a balancing column, with such functions as enable it to create a circulation that is not dependent upon gravity or the incoming water of condensation, but wholly upon the flow of steam from a higher to a lower pressure, and so arranging the mechanical device that this flow will carry water with it. Therefore, even though the source of condensation is far above the boiler, the principle of the loop is just as applicable to constantly and positively remove water as though it were below, and its virtues are just as essential. If the height above the boiler is far in excess of the head due to maximum difference of pressure, the loop may take the form of a straight pipe, the first section of which may be considered a riser, the second a horizontal, and the last or lowest a drop-leg (see Fig. 5). Such a pipe would be a limiting case of steamloop, its shape distorted, but its functions retained. The true action occurring in such a pipe has heretofore been imperfectly understood. Indeed, it is quite probable that no one has considered it deserving of especial consideration until the steamloop was devised and explained.

Distance.—It might not be unreasonable to suppose that the steamloop's application would be quickly limited by the distance of the separator from the boiler, and that the length would introduce complexity or uncertainty of action. Extreme length might impair its action, although even this is questionable; but at the greatest distances thus far met, of 800 to 1,000 feet, no adverse conditions have been encountered. Great distances cause proportional drop of pressure within the loop itself, requiring proper allowances to be made in height of drop-leg.

The temperature of return is also affected, due to the cooling effect of long pipes, and can be largely controlled by proper covering. The drop of pressure mentioned above, due to the length of loop, occurs only when a horizontal is extremely long, hence is rarely met in practice. In extensive systems the horizontal is made only the functional length, turning into the drop-leg, which descends, and at a proper level can be led away through piping of any form to the boiler (see Fig. 6), it being evident that when the drop-leg has descended to the level of boiler water, all further connection to boiler, whether 1 foot or 1,000 feet, becomes merely an ordinary pipe through which water will seek its level as through a pipe connecting two barrels, into one of which water is poured. Thus, distance will be noted to impose no practical limit on the loop's application, for it causes no change in the loop itself.

[To be continued.]

A Factor of Safety.

According to the *Iron Age*, although the term "factor of safety" was originally adopted as a technical expression by civil and architectural engineers, it has, by imperceptible degrees, become almost universally used in connection with all branches of constructive engineering. It may be defined as a numerical expression of the value or that percentage of the ultimate or breaking strain of the material which may be safely supported by the different elements or members entering into the construction of a building, bridge, machine, or other structure subjected to such strains. Thus, a "factor of safety of 4" means 25 per cent. of the breaking strain; 5, 20 per cent.; 8, 12½ per cent., etc.

Unquestionably one of the most important of the multifarious functions of the engineer is that of determining what this number should be. It is essentially a matter of judgment, dependent solely on the experience and professional skill of the individual. Since the safety of life and property may depend upon its correctness, it becomes one of the gravest responsibilities possible to be voluntarily assumed.

What, for instance, can be conceived more terrible in its effects than the collapse of a large dwelling, manufacturing or office building; the fall of a railway bridge, or breakage of a rail under the strain of a rapidly moving passenger train; the explosion of a boiler on a steamer out of reach of the shore? In such accidents as these, the destruction of possibly thousands of dollars worth of property becomes a matter of relatively little importance as compared with the wholesale destruction of human life, which is the almost inevitable consequence. And yet the daily papers tell us of the continual occurrence of just such accidents; and although from their very frequency they may fail to attract more than passing attention, unless of an unusually appalling character, the fact remains that the loss of even a single life entails upon someone a terrible load of responsibility. If the cause of the breakage leading to such results may be traced to the careless or ignorant use of the all important factor of safety in originally designing the construction, to whom does this responsibility belong if not to the engineer? Therefore the engineer becomes another, or, in fact, the factor of safety, for to him is entrusted the problem, and of his skill the factor of safety is the creation.

By none will the truth of this assertion be more promptly conceded than by the really competent and conscientious engineer. There are many instances on record in which this feeling of responsibility for disaster caused by the failure of their work has driven such men to insanity or suicide, and, in not a few of these, subsequent investigation has shown the cause to have been distinctly due to other than constructive faults.

But there are engineers and so-called engineers. The former, as a rule, men of more than average intellectual caliber, whose natural analytical habit of thought leads them instinctively to consider the relation between cause and effect. To such—even though not originally educated for the profession—the necessity for a general understanding of theoretical and applied science becomes at once apparent as the very basis of the technical information required to enable them to follow this occupation. Such men, and only such, are fit material of which to make engineers. And the greater their attainments, from study and practical experience, the more they are able to realize how exceedingly limited is their knowledge, as compared with what there is still before them unlearned.

In sharp contrast to the former class is the man who "knows it all." He also is engaged in engineering pursuits. But he sneers at science, says "theory and practice don't always agree," despises "book engineers," and works by "rule of thumb," glorying in the thought (and in the very frequent expression of it) that "he is a practical man, and didn't need to learn his business out of books." This man, if designing a machine, building, or what not, will consult his 2-foot rule, and with his two thumb nails moving back and forth on the graduations, will finally come to a decision and "guess he'll make that rod of 2-inch iron," or "that plate ½ inch thick;" and it is so ordered. He is totally and sometimes wilfully oblivious to the fact that there are very simple rules and data which would enable him to calculate instead of guess what the size should be, provided his boasted "practical" knowledge and experience of the physical properties of the different forms as well as kinds of material is adequate to the occasion. He has then but to decide as to the proper factor of safety, and the strength of his construction becomes a known quantity—that is, the safe though not necessarily the maximum strength. But he has no use for formulæ, tables, nor calculations, nor for the factor of safety; though why there should be any more necessity for accurate measurements in executing the work than in designing it, for using his foot rule and tape measure than his mathematical rules and data, would puzzle a logical mind to determine.

Surely it cannot be any more important that the individual members of the construction should be of dimensions which will admit of their being properly assembled, than that, as a whole, they should possess sufficient strength to render them safe to use for the purpose to which the construction was designed. If he wishes to truss a 20-foot beam, to increase its capacity 25,000 pounds, it would seem to be quite as foolish to use a rod of proper length, 1 inch diameter, when 2 inch was required, as it would be to try to make one of proper diameter of 10 feet length answer the purpose for the given span.

By the foregoing it is not by any means intended to convey the idea that only the highly educated are fit to be intrusted with work of this character. On the contrary, there are many among the ablest engineers in the profession whose early advantages were of the least, and yet they have attained to deservedly high reputation by their skill through natural ability alone. But it may be safely asserted that they have been, without exception, men of the quality of intellect we have described, and that, before they became thus proficient, the necessary technical education has been acquired against any and all obstacles.

On the other hand, neither does it follow that, because a man may have a thorough technical and general scientific education, he will make a competent engineer. He has the formulæ at his finger ends, knows the strength of material, can work out problems involving the use of the higher mathematics, and in all respects, save one, possesses the requisite

qualifications of an engineer. But he lacks the judgment necessary to enable him to correctly determine his factor of safety, without which all of his other knowledge is, not useless, but positively dangerous; it is like an arch with the keystone left out. Or, it may be that, while possessing the judgment, he is deficient in wisdom to follow it, and allows his desire to reduce cost, or some other motive, to tempt him into reducing his factor of safety below the number dictated by his judgment, and deliberately taking risks involving not only the safety of his professional reputation, but that of the property and lives of others who were not consulted, nor had any voice as to whether or not they were willing to share the risk. In other words, he takes the risk at other people's expense. We are not sure that this character of incompetency—for such it undoubtedly is—may not be considered as the most dangerous of all; and that it exists to a serious extent is beyond question. It is due to the active competition for the securing of contracts, in which the generally satisfactory design, costing the least money, is the one usually sure of acceptance. This applies more particularly to architectural engineering, which of late years has become of the greatest importance as to magnitude of operations, owing to the immense number of large buildings continually being erected; and in no class of work could the risk be more inexcusable, nor the results more appalling in case of disaster.

Of course it does not follow that because the strength is insufficient to insure safety, the structure must inevitably give way. It was the "last straw that broke the camel's back;" so in testing material up to its breaking strength, it bears to within an infinitesimal amount the strain which finally produces rupture. An overloaded column, wall or girder will not give way until the breaking strain is fully reached, but the elastic limit of the material once passed, the danger becomes imminent—the least unusual jar, vibration or increase of load in any manner being liable to produce rupture. Cases might be cited *ad infinitum* in illustration of this fact, where buildings, bridges and other structures have given way, when under no perceptible increase of the ordinary load, and upon investigation as to causes of the accident, which naturally followed, it would be discovered that the ordinary load was close to the breaking limit. It not unfrequently happens that a building which was designed to bear the strains due to the purpose originally intended, may be wrecked by a criminal carelessness in overloading it many times beyond what was contemplated in its design. This, of course, is no fault of the engineer, although he may possibly have to bear the blame, at least until investigation shall have exonerated him, which is by no means a certainty, as some can testify to their sorrow. As to the different points to be considered in determining the factor of safety, their name is legion. The chemical and physical properties of materials, the shape and probable condition of comparative soundness of the various members, uniformity or variability of conditions affecting the strains, etc., are some of the most important points; but there are others which, though quite as important, are not so apparent, and are more easily overlooked. It is the consideration of these multifarious features, overlooking none, and giving to each its correct relative as well as individual importance to enable him to arrive at its true value, which constitutes the engineer "a," if not "the" factor of safety.

Electric Transmission of Power.

M. Marcel Deprez, in a communication to the Paris Academy of Sciences, gave an interesting account of an installation he had erected at Bourganeuf in the Department of Creuse, France. The first attempt to light this town electrically was made two years ago, when a turbine was erected below a fall of water in the town itself, and the power thus obtained employed to operate dynamos. Unfortunately this particular fall on several occasions during the summer ran dry, and it thus became necessary to supplement the turbine by steam power. As, however, there were several falls in the vicinity of the town which were not subject to this failing, the municipality determined to erect a turbine at one of these and transmit the power to the heart of the town by means of a high tension electric current.

The site finally selected for the erection of the turbine was the Jarraud Falls, nearly 9 miles from Bourganeuf, where much more power was available than was actually required. At this point a cast iron pipe 1 m. in diameter has been erected, which conducts a portion of the available water supply to a turbine with a horizontal shaft, which is capable of generating 130-horse power, the fall being 98 feet 6 inches. This turbine has been erected on the ground floor of a building on the first floor of which has been placed the dynamo. The turbine runs at a maximum speed of 130 revolutions per minute, and drives the dynamo by a belt at 650 revolutions. Attempts to regulate the turbine speed automatically were made when the installation was first erected, but this plan has since been given up for that of hand regulation. The dynamo has two armatures mounted on the same shaft and two straight field magnets. The second armature takes the place of the yoke piece of an ordinary machine, and M. Deprez claims that this plan considerably reduces the weight of the machine. In support of this he states that he has constructed in this way a 12-horse power dynamo which weighed only 660 pounds, though neither the current density nor the speed of the machine was greater than common.

The field magnets of the above dynamo are separately excited by a low tension machine, which supplies a current of 18 amperes at a potential of 90 volts. The armatures of the high tension machine have a resistance of 2 ohms, and the electromotive force generated, when these make one turn per minute, is from 5 to 5.5 volts. The wire on the armature is 0.0866 inch in diameter, and can carry without danger a current of 25 amperes. The line between the falls and the lighting station consists of two uncovered wires, of silicium bronze, 0.197 inch in diameter, supported by porcelain insulators on pine posts. The line has a resistance of 23 ohms, and even in wet weather its insulation is stated to be practically perfect.

The motor at Bourganeuf is similar in construction to the generating dynano previously described, its magnets being excited by a current from the lighting machines. As, however, when the latter are at rest no exciting current can be obtained from them, accumulators are used for the starting, the motor being cut out as soon as the potential at the terminals of the lighting machine reaches 130 volts. The normal speed of the motor is 500 turns per minute, and it is regulated by altering the resistance of the transmission line in the following manner: Connected up with this line is a liquid rheostat by which the resistance of the line can be altered from a few ohms up to some thousands. Pure water constantly renewed is used in this instrument, and with it M. Deprez states that he has been able to open and close the 5,000 volt circuit at Creuil 20 times a minute without damage.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, Oct. 10, 1891.

Status of the Gas Industry—Gas and Electric Light at Cork—A Big Gasholder at Glasgow—The Amyl-Acetate Standard—Cheap Heating Gas—London Fogs.

Dull, wet weather has prevailed during the last few days, bringing with it gloomy days and dark evenings, resulting in premonitory warnings that the lighting season of 1891-2 is now upon us. The majority of gas engineers are ready for it. Those who had not already previously learned the importance of foresight in gas works matters had such a decisive lesson last season that the memory of it has not yet passed away, and so ample stocks of coal, retort house furnaces all in order, extensions of all kinds completed, are the regular thing this year. At this period of the year, also, gas consumers begin to bestir themselves, and it is satisfactory to be able to note that the demand for gas continues in a healthy state of activity and progression. The principal line of advancement is perhaps in the adoption of high power regenerative lamps for outside shop lights as well as for the illumination of interiors. The demand for these is stimulated by the general adoption of the plan of letting them on hire. I took up this scheme last year, and with satisfactory results, having now some six dozen large lamps in regular use. It is just as easy, and preferable for many reasons, to do this at once, as to wait till an electric lighting supply is set up. The usual practice has been, whenever this event happens, to adopt a more liberal policy in the way of letting apparatus on hire, etc., and then to take credit for selling more gas than before the electric light started. This seems to me like a confession of weakness, for if 5 per cent. more gas can be sold in spite of the electric light, then at least 10 per cent. could be sold in its absence. There is also a satisfactory increase in the demand for gas engines and in the application of gas to special technical purposes, whilst the modern improvements in gas heating stoves and fires must not be passed over. So the consumption of gas will certainly not be less during the present than in preceding seasons.

But it is not in the consumption of gas alone that advancement is noticeable. I have already alluded to the adoption of hydrocarbons as enriching materials by the London Gas Companies. On all sides there is the introduction of gaseous firing, inclined retorts, machinery for the conveyance of coal, coke, etc. In some works the coal passes to the retort, and the resulting coke into the purchaser's cart, without being touched by a shovel or other manual implement.

These things may serve to compensate for the increased cost of coal

and labor—an increase which is unfortunately not attended with improvement in quality in either case—and help gas companies to earn their dividends without increasing the burden on the consumers.

The Gas Company at Cork, Ireland, are about to undertake the supply of electricity for lighting to such of their consumers as require it. The noticeable feature about this undertaking is that, instead of supplying from a central station, a number of small stations are to be scattered about all over the district, gas engines being used as the motive power. This innovation suggests several considerations. The cost of conveying large quantities of electricity considerable distances, generally supposed to be large by reason of loss due to leakage, will be saved. On the other hand, the small stations will necessitate additional capital outlay in the way of buildings, excess or duplicate apparatus, etc. They do away with the loss of heat inseparable from the use of steam as a source of motive power, and the Company will be in a position to supply themselves with gas at cost price. The plan also appears to reduce the difficulties due to occasional failure or derangement of any parts of the apparatus. The results, financial and otherwise, of the new departure will be watched with the greatest interest, both by gas and electric lighting circles, and should they prove satisfactory it will no doubt be adopted in many wealthy residential districts, fashionable watering places, etc.

A large gasholder is to be built at Glasgow. The contract for the tank has just been signed, and this alone will cost nearly £20,000. The tank is to be 240 feet in diameter and 45 feet deep. The foundation for the wall is to be 15½ feet wide, and on this the wall is to be carried up for one-third of the height, 7 feet 6 inches in thickness, from which it is gradually reduced by four set-offs to 3½ feet at the top, which will be finished off by coping stones 3 feet 9 inches wide, 12 inches thick, and not less than 3 feet long. A year is to be allowed for the completion of the work, but if finished to the satisfaction of the Engineer a month before the expiration of this time, a premium of £500 is to be paid to the contractor. This seems an improvement on the usual plan of mentioning a large penalty for delay in the fulfillment of the contract, which in practice is never enforced, and indeed cannot be legally claimed except by proving damages to the full amount. There will be 26 piers for the reception of a similar number of standards, at equal distances round the tank, and the holder will comprise three lifts. It will rise to a height of 125 feet, and contain nearly 6 million cubic feet of gas.

I notice that the German Gas and Water Works Managers Association has lately been giving some attention to the lighting value of the Hefner-Alteneck amyl-acetate light standard, as compared with the English sperm candle, with the result that the former is shown to possess a lower lighting value than had previously been supposed. In 1885, Herr Drehschmidt found that the candle was rather the better of the two, one candle being equal to 1.048 Hefner light. Some other scientists, about the same time, obtained somewhat similar results, as they recommended that 4 per cent. should be deducted from the results obtained by the medium of the amyl-acetate lamp in order to obtain the same in terms of the standard candle. Recent observations by Herr Drehschmidt gave a result of 1 candle = 1.30 Hefner light. He has also found that different samples of the amyl-acetate used give discordant results, and points out the necessity for exercising some control over the manufacture of amyl-acetate intended for photometrical purposes. The complex nature of the fluid hydrocarbons and the difficulty of completely isolating any one of them from others, show that difficulties of this sort are only to be expected.

Prof. Lewes, whose lectures at the Society of Arts on illuminating gas will be well remembered, has lately taken out an important patent in connection with the manufacture of water gas. One objection to this kind of gas is the presence in it of a considerable portion of carbonic oxide, which is not only extremely poisonous, but possesses a high specific gravity which increases the cost of distribution. According to Prof. Lewes' invention, however, the carbonic oxide may be entirely removed, or reduced to any desired extent. It is known that if steam is passed over red hot metallic iron, decomposition ensues, resulting in the formation of oxide of iron, and hydrogen. But the difficulty hitherto experienced is that the iron is soon used up. It rapidly acquires its complement of oxygen, and then the operation is stopped. Prof. Lewes proposes to "revivify" the iron by passing ordinary producer gas over it, when the carbonic oxide in the gas is converted into carbonic acid by absorbing the oxygen from the oxide. The iron is thus restored to its original metallic state. If we place a retort packed with iron in an ordinary generator, heat up the same in the usual manner, and then pass steam previously superheated into the retort, hydrogen gas is produced. As soon as the decomposition of steam begins to flag, the supply of steam is stopped, and the blast is caused to traverse the retort, not only restoring the iron, but heating it up to the proper temperature, by the combustion of the carbonic oxide. So that by working in runs in the manner usual with water gas apparatus, practically pure hydrogen, with or without any desired proportion of water gas, may be obtained. This process, if proved to be workable and reliable in a practical way, will be largely adopted wherever enriching materials are cheap as compared with bituminous coals. Whether used in the crude state as a heating gas, or as a body for the conveyance of hydrocarbon vapors for illuminating purposes, hydrogen possesses special advantages as compared with carbonic oxide, or indeed any other combustible gas.

The subject of fogs in London and our principal towns, due to the large quantity of black smoke that is belched forth from the throats of countless chimneys, always crops up at this season of the year. The same threadbare old statistics are once more brought out from the rubbish cupboard, where they have reposed for about a twelvemonth, and the public are once more enlightened as to the cost of a foggy day, as shown by the increased consumption of gas; allusion is once more made to the damage done to buildings, furniture, decorations, etc., by the deposition of soot, to the necessity for frequent whitewashing, painting and gilding, and to the funereal appearance rapidly acquired by the principal public buildings; the atmosphere of London and Manchester is compared to that of Paris or of Pittsburgh, to the discredit, of course, of the first mentioned places; various elaborate investigations as to the presence of unconsumed carbon, dust germs, etc., and as to the thickness of the fog and the number of tons of carbon contained in it are put forth. After about three hours of this sort of thing it occurs to somebody that something ought to be done. So various suggestions, mostly of a wild and unpractical character, are put forward. The escape of black smoke from a chimney is to render the owner or occupier liable to be indicted for a penal offence; manufacturers are to be forced to use smoke consumers, and so on. Or perhaps various suggestions as to the use of fuel gas are forthcoming. Some say that foggy air is a sort of paradise to those wonderful "germs" that have so much to do with health and disease; but others think that the traces of sulphur acids which accompany the smoke do not agree with them, and act as disinfectants. The public, like Gallio, care for none of those things, and the production and evolution of smoke goes merrily on. Gradually, no doubt, they will become educated to the advantages of smokeless fuel, but the process is very slow. The only progress in that direction that can be recorded, is the adoption of coal gas to many uses that have hitherto been covered by solid fuel.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

A STRIKING feature of the recent Industrial Exhibition at Strasburg was the display of gas engines, the exhibitors of which took especial pains to put in the competition the very finest specimens of their apparatus. All the prominent types were represented, and many were also shown which have yet to gain their reputation through the test of practical service. At the end the judges decided to award the highest gold medal and diploma for "superior design and workmanship" to the Otto type of gas, gasoline and petroleum engines. Second prizes went to Messrs. Adam, Benz Lombart & Co., Hille, the Kobers' Iron Works, and Escher, Wyss & Co. The third prizes were awarded to Grob & Co. (Capitaine petroleum motor) and Messrs. Korting & Co. It will thus be seen that the Otto engine easily leads all its contemporaries.

IN our last issue we noted that President Betts and Superintendent Curley, of the Wilmington (Del.) Coal Gas Company, had announced another reduction in gas rates, which virtually amounted to a concession of 10 per cent. on the prices formerly charged. The gross rate is put at $1.25 per 1,000 cu. ft., and prompt payment secures to the consumer a rebate of 10 per cent. from the gross. The concession took effect on gas supplied from October 1st, and will not carry much consolation or afford greater confidence to the projectors of the Wilmington Oxy-Hydrogen Company, whose proprietors, it may be remembered, recently handed in a bid in the competition for the public lighting of the city, despite the fact that the main pipes were not even on top of the ground, much less underneath it. President Betts (to whom we are indebted for a copy of the announcement), in calling the attention of the residents to the low gas rate that had been agreed upon, caused the preparation and publication in the local newspapers, of a well-worded circular, in which many valuable hints respecting the use of gas for lighting, cooking and power purposes are effectively arrayed. The concluding paragraphs of President Betts' circular are appended:

"It sometimes happens that our customers are not getting the best results on account of dirty or bad burners, dull shades or antiquated fixtures, and that poor light and smoky ceilings follow. To any who are incommoded from this or any other cause, we request that immediate notice be sent to our office, Third and Shipley streets, by mail, telephone or messenger.

"The price of gas in this city in 1864 was $3.50 per 1,000, and by nine successive reductions has reached $1.12½ per 1,000 at this time. With improved apparatus and a liberal consumption by our citizens, we hope still further reductions may be made in the future.

"We wish to sell the best gas at the lowest price and to have it economically and comfortably used by our customers, and if they will report promptly all deficiencies we will do our part in having them corrected."

AT the annual meeting of the Troy (N. Y.) Gas Company the following named gentlemen were elected a Board of Trustees: Messrs. Edward Murphy, Jr., Wm. Kemp, A. Bleecker Banks, Anthony N. Brady, Thos. Breslin, F. E. Draper, Joseph Fales, James Fleming, Samuel O. Gleason, George P. Ide, F. J. Molloy, R. C. Pruyn, and Wm. A. Thompson.

MR. HENRY S. WHIPPLE, Manager of the Rockford (Ill.) American Gas Light and Coke Company, has been authorized to announce the following schedule of gas rates, to take effect on and after the 1st prox.:

Monthly Consumption.	New Net Rate per 1,000.	Old Net Rate per 1,000.
Under 500 cu. ft.	$1.70	$1.80
500 cu. ft. to 2,900 cu. ft.	1.60	1.70
3,000 " 9,900 "	1.50	1.60
10,000 " 19,900 "	1.40	1.50
20,000 cu. ft. and over.	1.30	1.40

Accounts not settled after the sixth day from the rendering of the bills will all be charged at the uniform rate of $1.80 per 1,000 cubic feet. Manager Whipple accompanied the schedule promulgation with the following remarks: "The Gas Company has spent a large amount of money in improving the plant, replacing the main pipes with larger ones, laying new pipes in all directions, reaching the city limits in every section, and extensions are in progress and under consideration. The service to the city and to the consumers has been improved without cost to any, and all defects when brought to the notice of the management will be remedied at once. This is the second reduction that has been made since the Gas Company has been under the control of the present owners, who hope that it will result in an increased consumption which will enable them to make another reduction."

WE are indebted to a correspondent for the following, which explains itself: "On the 14th inst Mr. Tolles, of the legal firm of Henderson, Kline & Tolles, filed in the office of the United States Circuit Court for the district of Cleveland, a bill of complaint against the city on behalf of the Cleveland Gas Light and Coke Company. The bill in equity is a lengthy one, the main claim or cause for action being that the ordinance reducing the price of gas, and circumstances surrounding the reduction as well, are unconstitutional. On Feb. 6, 1846, as the bill recites, the Legislature passed by special act the law granting the Cleveland Gas Light and Coke Company its charter. Some time after this grant was made, the Legislature passed section 2478 of the Revised Statutes. It is the construction that has been placed upon this section that the plaintiffs object to most particularly. The section itself gives the power to Councils of all Municipal Corporations of Ohio to fix the price of gas. Some years since, the Ohio Supreme Court decided, when called upon to interpret this act, that the section means and should be so construed as giving to the Councils of municipal corporations the absolute right to fix and determine the price of gas, and that when the Council, acting in good faith, has fixed the price, it is not material in the trial of a suit to test such action, whether the price so fixed is reasonable or unreasonable, or whether the gas company is affected one way or the other, and no such issue should be allowed. The Gas Company's bill of complaint, referring to this decision, says: 'Your orator admits that there is no law in the State of Ohio by which your orator is or was entitled to a hearing before the City Council when it proposed to take action under said statute fixing the price of gas, and your orator submits and alleges that said statute is in contravention of Section I., Article XIV., of the Constitution of the United States, in this: That it authorizes the taking of the property of your orator without due process of law, and withholds the equal protection of the law, as guaranteed.' The Company then claims that it values its gas plant at $2,500,000, that it is manufacturing and selling good and merchantable gas to the city, and the inhabitants, at a reasonable and just price, yielding no more than a fair and reasonable profit upon the capital actually interested. The price so fixed by the Council, the bill continues, is not fair, reasonable or just compensation, but by compelling the Company to furnish gas at 60 cents per 1,000 cubic feet, it would ruin and destroy its business and render its property of little or no value. The city itself consumes one-fifth of the gas manufactured by the Company, and refuses to pay more than 60 cents. The bill states that the city is debtor to the Company in the sum of $30,000, which is increasing at the rate of $6,000 per month. In conclusion, a writ of injunction is asked perpetually enjoining the city from 'in any manner enforcing or attempting to enforce the provisions of said illegal ordinance, or from instituting threatened proceedings for the forfeiture of your orator.' A preliminary injunction to restrain any action of the kind on the part of the city while the case is pending was also demanded. The bill of complaint bears President Morley's signature, and the attorneys retained in the case are Squires, Sanders and Dempsey, Boynton and Hale, J. M. Jones, and Henderson Kline and Tolles."

IN the meantime Patrick Cunningham, a resident of Cleveland, and a customer of the Gas Company, has instituted *quo warranto* proceedings, in the name of the County Prosecutor, against the Cleveland Gas Light and Coke Company, complainant setting up the passage of the 60 cent gas ordinance which he asserts the Company is seeking to evade. Sixty cents, Cunningham avers, is a reasonable price per 1,000 cubic feet for gas, which rate he tendered the Company in payment for gas consumed by him during September. The Company refused the tender, and sent an employee to shut of his gas, wherefore he pleads that the Company, "in assuming to charge the higher figure and to cut off his gas supply, usurps a right and exercises a privilege not belonging to it, hence in contravention of the law." He asks that the Company be compelled to answer by what warrant it claims these rights, and for "such order as justice may require."

THE Delaware Iron Company's plant, at New Castle, Del., which was recently destroyed by fire, will be rebuilt, Messrs. Morris, Tasker & Co. having authorized the Berlin Iron Bridge Company to construct them a plant, to be built of iron from designs furnished by the Bridge Company. This will be a marvel of quick construction, as the contractors have bound themselves to complete the works by December first.

MR. ROBERT ALBERTSON, of Rockford, Ills., has accepted a position on the clerical staff of the South Chicago Gas Company. Mr. Albertson is a clever, wideawake fellow, and will make many friends in the windy city—and keep them too.

THE Pennsylvania Globe Gas Light Company is altering all the lamp reservoirs on its gasoline lamps for public lighting to what is known as the half-gallon standard.

MR. GIRD STACEY has been appointed Collector for the Marblehead (Mass.) Gas and Electric Light Company.

PEABODY, Mass., will at once erect an electric lighting plant to be operated on municipal account, all the preliminaries under the act of last spring having been complied with. The sum of $47,000 has been appropriated, but some of the wiser calculators are of the opinion that that amount will not be sufficient.

"THE New England Patent Gas Company," F. S. C. is informed, was formed for the purpose of exploiting the William Harkness patent gas process in New England and in foreign countries. We believe that Mr. Harkness is a resident of Providence, R. I., that the capital stock of the Company is $1,000,000, and that its process will not revolutionize existing methods of gas making.

THE death of Mr Edward Hilliard, a Director in the Easton (Pa.) Gas Company, and a prominent citizen of that city, is reported. He was in his 66th year.

THE Butler (Mo.) Gas and Electric Light Company, the proposed formation of which had been noted in the JOURNAL, has been incorporated. It is capitalized in $15,000.

THE Alamo Electric Company, of San Antonio, Tex., has been put into the hands of a receiver, upon application of the creditors. The receiver is Mr. L. W. Gregory.

MR. M. H. TAYLOR will remain in the management of the gas coal and other properties of the late Hon. W. L. Scott. In fact, this was a foregone conclusion, since in Mr. Scott's busy lifetime no other of his representatives enjoyed a fuller measure of his confidence and trust than did Mr. Taylor.

THE following extracts are taken from a letter written to the same friend in New York who so kindly permitted us, in our issue for Sept.

7th, to reproduce some interesting paragraphs from a letter then received by him from the same correspondent, Mr. Sylvester Watts. Mr. Watts, who writes from Rome, Italy, under date of October 2d, says: "Friend ——, I received with pleasure your letter of August 30th. * * *. Myself and family go from here to Naples, thence to Brindisi, from which latter place we sail, on the 12th inst., for Egypt. I called yesterday at the Rome gas works, and met Mr. Walter R. Jones, the Superintendent of the Company. Mr. Jones is patentee of the bench setting, a description of which was read at the last St. Louis meeting of the Western Gas Association. The bench is simply and economically constructed. The furnaces require no clinkering and last as long as the retorts, and the results obtained consist of a saving in labor and the *sale* of 63 per cent. of all coke made, as per coke sales book. He uses, however, in addition to the 37 per cent. of coke for firing, about 1 per cent. of the tar made. This tar is mixed with the fine breeze before it goes into the furnace. The 63 per cent. is the choicest coke. He gets 5 feet per pound of Newcastle (English) coal. Coal costs $5.40 per long ton, and he carbonizes 60,000 tons per year. The gas is sold at $1.30 to $1.40 per 1,000 cubic feet. The streets are all lighted with gas, and the city pays $1.30 per 1,000 for all gas used in the street lamps. The Gas Company is furnishing a few arc electric lights to stores, but owing to high price of fuel Mr. Jones says there is no profit in the business. A project is now on foot, however, to utilize the water power at Tivoli, 25 miles distant, for electric lighting. Mr. Jones impresses me as being a very economical manager. He has erected an apparatus for revivifying his oxide of iron. It consists of a dozen oil barrels filled with the oxide and connected with pipes, by which a small stream of water is passed through the barrels. Entering at the top of the first, the water passes through the material, then enters the next, and so on through the set. He assures me that he can by this process make the material do as much purification as when new, that the material will bear two or three washings and do good work, and all at a trifling expense. About 5 per cent. of slaked lime is mixed with the oxide before washing. The water is then passed on to an evaporating pan, and, after evaporation, leaves a thick paste which is sold to chemical works. He showed me a sample of Prussian blue made from this paste. He also pulverizes his old retorts, and, after mixing with fresh fireclay, moulds and burns all the tile and brick used for bench repairs. The Rome gas works were built in 1848, by Mr. Shepherd, on the Tiber, at the foot of the Palatine Hill, where stand the ruins of the Palace of the Cæsars, and within a short distance of the Roman Forum. * * * The year (1848) when the works were built seems but yesterday in comparison with the age of the monuments which surround them, so that by comparison here in Rome we may safely say that the gas business is still in its infancy. The builder of the works died in 1870, and the stockholders of the Company have placed on the square base of one of the large smokestacks, opposite the front gate of the works, a large white marble slab, on which is a fine, life size medallion, in bronze, of Mr. Shepherd. The following inscription in bronze appears also:

All Memoria
di
CIACOMA SHEPHERD,
Cli Azionista,
Anno, MDCCCLXX.

There it stands, a lasting memorial to the pioneer of the gas business in Rome. This is an example that should be imitated by stockholders in our own country, in remembrance of those good and faithful servants who spent their lives in building up a business that has been a source of so much comfort and pleasure to the communities, and which, for all time, will be a source of profit to the shareholders. The gas managers of Europe are evidently trained to practice more economy in their management than those of our country; but they possess advantages, such as cheap labor and a ready demand for all the bye-products arising from their business. Under the same conditions they might not be able to show any better results than those of our managers." * * *

THE new holder for the Hackensack (N. J.) Gas Light Company is a great boon to the gas service of the district, which leads to the remark that the percentage of increase in the sendout must be well into two figures—as between 1890 and 1891.

ANOTHER contract recently received by the Berlin Iron Bridge Company is that for the new blacksmith shop building for the Dixon Manufacturing Company, of Scranton, Pa. Owing to the peculiar formation of the ground the building will be in the form of the letter L. It is to be 60 feet wide by 235 feet in length, and will be constructed wholly of iron.

THE gas war at Terre Haute, Ind., still continues, with Mr. Diall's forces well to the fore. In the meantime both parties in the conflict must find it rather expensive.

MESSRS. GLOER BROTHERS, of Atlanta, Ga., through Mr. George P. Roberts, Attorney, have brought suit against the Atlanta Gas Light Company, in which they ask for $2,000 damages. In the declaration plaintiffs aver that they were doing business at 23 West Mitchell street, and began to use gas from the defendant's service on October 15, 1890, continuing such use up to August 31, 1891, when the Company shut off the gas and removed the meter. The Company's defense is that plaintiffs failed to comply with the regulations under which the gas service was to be carried on.

THE Nebraska City (Neb.) Gas Company's works were slightly damaged by fire on the 14th inst.

THE collieries of the Madison Gas Coal Company, at Arona, Pa., are working on "full time." Thos. Donohoe, Jr., has been appointed Superintendent, and Martin Donohoe acts as Mine Boss.

AT the annual meeting of the Woonsocket (R. I.) Gas Company no change was made in the board of officers. The annual reports were of the most satisfactory sort.

THE Buffalo (N. Y.) *Courier* says that the Erie County Natural Gas Company's line has been put under and across the Niagara river, at a point opposite the foot of Hamilton street, Black Rock. So much trouble was experienced in "pulling" it across the stream that it was finally decided to raise the line (8 inches is its diameter), placing it on the bow of a scow, when tong men were to put the line together, which was to be carried to the shore connection. The 1½-inch wire cables, to which locomotives had been attached in an endeavor to pull the line ashore, had proven entirely insufficient to stand the strain to which they were subjected.

MR. H. L. MANSFIELD has been elected Secretary and Treasurer of the Middletown (Conn.) Gas Light Company.

THE Wolverton Glow Arc Electric Light Company was incorporated for New Haven, Conn., by John E. Wolverton, William McCubbin and James N. Cox. It is capitalized in $250,000.

KANSAS City, Mo., complains that "the present electric lighting service in the city is altogether inadequate to the needs of the place, and the desire is to have the service extended." On the other hand, about as many more insist, while admitting that the service is inadequate, that the great cost of extending the same would not justify the increase that would have to be made in the tax rate to meet the expense entailed.

THE fuel gas operators still have their windward vision on Connersville, Ind., as a likely place to locate one of their nitrogenous schemes.

Asbestos Mining in Canada.

Reliable data in respect to this shows that up to within a few years ago, by far the greater part of fine asbestos fiber adapted for spinning came from the mines of Italy and Corsica, and its price ranged from $250 to $300 a ton. The recent discovery of immense quantities of the valuable mineral in the province of Quebec has almost revolutionized the trade. The output of the Canadian mines, which are all comprised in a very small circuit, has increased from 50 tons, in 1871, to 8,000 tons in 1890, and prices have advanced, until, notwithstanding the largely increased production, the No. 1 Quebec asbestos now commands almost as good a price as the best Italian. This is not only due to the superior quality of the article, but to the variety of new uses to which it is applied, and which are increasing almost daily. The commoner grades continue, as before, to be manufactured into steam-packing and fireproof building felt.

Though it was known some decades ago that there was asbestos in the eastern townships, it was only a few years ago, when the burning of the forest in Thetford and Coleraine laid bare the hills of serpentine, that the abundance of the deposit was discovered. Now there has sprung up in each of those townships populous mining villages containing 2,000 to 3,000 souls each, and large quantities of the product of the mines are almost daily shipped to Boston.

The profits derived from some of these mines are simply enormous. Thus, the Johnston-Irvine mine at Thetford, which some five years ago might have been bought for $5,000, now returns to its owners an annual profit of $100,000, producing as it does the finest quality of the mineral, a large proportion of which sells from $275 to $300 a ton, while the method of mining it is the crudest and most elementary imaginable. There is little or no excavation before the asbestos is reached, but the veins of the fiber are blasted out of the surface rock, and men with hammers separate the portions of rock that adhere to the pure asbestos, which is at once sorted into grades for shipment.

Some of the finest mines in Coleraine have been disposed of at a high figure to a firm of manufacturers of and dealers in asbestos goods at Frankfort. This firm is about to introduce improved machinery from Europe into these mines, not to increase the production, but to lessen its cost. There would be no difficulty at all in largely increasing the output of the mines, but the miners have a practical understanding among themselves, to keep up the price of the raw product by allowing the demand to regulate the supply. Within the last few weeks there has been an attempt in Europe to reduce prices, manufacturers having quietly accumulated a certain amount of the mineral in excess of present requirements. The miners are equal to the emergency, however, and are storing the output of their mines here instead of shipping it on consignment.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

October 26.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	99½	100
Central	500,000	50	—	90
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	119	121
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	119	121
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	40	45
Preferred	5,000,000	100	—	82
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	101	—
Citizens	1,200,000	20	88	90
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	111	112
" Bonds	300,000		100	105
Peoples	1,000,000	10	64	—
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	92	—
" Bonds (5's)	70,000	—	—	—
Nassau	1,000,000	25	130	—
" Ctfs	700,000	1000	98	100
Williamsburgh	1,000,000	50	105	—
" Bonds	1,000,000	—	105	109
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	84	86
2d " " "	3,000,000	1000	70	74
Bay State Gas Co.—				
Stock	5,000,000	50	—	56
Income Bonds	2,000,000	1000	98	102
Buffalo Mutual, N. Y.	750,000	100	105	110
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds.	45,000	—	—	—
Chicago Gas Company.	25,000,000	100	52½	52¾
Chicago Gas Light. & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	82	82½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	97½
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	—	100½

Advertisers Index.

GAS ENGINEERS. Page

Jos. R. Thomas, New York City ... 601
Wm. Henry White, New York City ... 607
Fred. Bredel, New York City ... 603
Jas. R. Smedberg, Peoria, Ills ... 601

CHEMISTS.

Durand Woodman, New York City ... 601

GAS AND WATER PIPES.

Meliert Foundry and Machine Co., Reading, Pa. (John Fox, Selling Agent, N. Y.) ... 601
Ohio Pipe Co., Columbus, Ohio ... 601
M. J. Drummond, New York City ... 601
R. D. Wood & Co., Phila., Pa ... 606
Warren Foundry & Machine Co., New York City ... 601
Donaldson Iron Co., Emaus, Pa ... 601
Addyston Pipe and Steel Co., Cincinnati, O ... 601

PROCESSES.

National Gas Light and Fuel Co., Chicago, Ills ... 598
Bartlett, Hayward & Co., Baltimore, Md ... 605
United Gas Improvement Co., Phila, Pa ... 597
Burdett Loomis, Hartford, Conn ... 594

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City ... 607
Continental Iron Works, Brooklyn, N. Y ... 592
Deily & Fowler, Phila., Pa ... 607
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 604
Stacey Mfg. Co., Cincinnati, Ohio ... 607
Bartlett, Hayward & Co., Baltimore, Md ... 605
Morris, Tasker & Co., Limited, Phila., Pa ... 605
Davis & Farnum Mfg. Co., Waltham, Mass ... 604
R. D. Wood & Co., Phila., Pa ... 606
Bouton Foundry Co., Chicago, Ills ... 607
Isbell-Porter Company, New York City ... 606
Fred. Bredel, New York City ... 603
United Gas Improvement Co., Phila., Pa ... 597
National Gas Light and Fuel Co., Chicago, Ills ... 598
Berlin Iron Bridge Company, East Berlin, Conn ... 594

INCLINED RETORTS.

Laclede Fire Brick Mfg. Co., St. Louis, Mo ... 556
Parker-Russell Mining and Mfg. Co., St. Louis, Mo ... 602

GASHOLDER TANKS.

W. C. Whyte, New York City ... 598
J. P. Whittier, Brooklyn, N. Y ... 599

GASHOLDER PAINT.

The Government Waterproof Paint Co., Boston, Mass ... 594

RETORTS AND FIREBRICK.

J. H. Gautier & Co., Jersey City, N. J ... 602
B. Kreischer & Sons, New York City ... 602
Adam Weber, New York City ... 602
Laclede Fire Brick Mfg. Co, St. Louis, Mo ... 602
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y ... 602
Borgner & O'Brien, Phila., Pa ... 602
James Gardner, Jr., Pittsburgh, Pa ... 602
Henry Maurer & Son, New York City ... 602
Baltimore Retort and Fire Brick Co., Baltimore, Md ... 602
Parker-Russell Mining and Mfg. Co., St. Louis, Mo ... 602
Boston Fire Brick Works, Boston, Mass ... 602

CEMENTS.

C. L. Gerould & Co., Brooklyn, N. Y ... 602

SCRUBBERS AND CONDENSERS.

G. Shepard Page, New York City ... 596
R. D. Wood & Co., Phila., Pa ... 606
James R. Floyd & Sons, New York City ... 600
Continental Iron Works, Brooklyn, N. Y ... 592

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md ... 605
Fred. Bredel, New York City ... 603
J. H. Gautier & Co., Jersey City, N. J ... 603
Parker-Russell Mining and Mfg. Co., St. Louis, Mo ... 602

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City ... 599
Fred. Bredel, N. Y. City ... 603
Wilbraham Bros., Phila., Pa ... 599

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Company, New York City ... 606
Continental Iron Works, Brooklyn, N. Y ... 592

TAR AND CARBONIC ACID EXTRACTOR.

Geo. Shepard Page, N. Y. City ... 596

AMMONIA CONCENTRATOR.

Michigan Ammonia Works, Detroit, Mich ... 591

GAS METERS.

John J. Griffin & Co., Phila., Pa ... 610
American Meter Co., New York and Philadelphia ... 611
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa ... 612
Helme & McIlhenny, Phila, Pa ... 611
D. McDonald & Co., Albany, N. Y ... 611
Nathaniel Tufts, Boston, Mass ... 610
Maryland Meter and Manufacturing Co., Baltimore, Md ... 610
Harris Bros. & Co., Philadelphia, Pa ... 610
Keystone Meter Co, Royersford, Pa ... 611

METER DIALS.

Caesar Bros., New York City ... 608

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind ... 596
Isbell-Porter Company, New York City ... 606
Wilbraham Bros., Philadelphia, Pa ... 599
Connelly Iron Sponge and Governor Co., New York City ... 599

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, New York City ... 593

GAS COALS.

Penn Gas Coal Co., Phila., Pa ... 593
Perkins & Co., New York City ... 596
Despard Coal Coal, Baltimore, Md ... 593
Chesapeake and Ohio R. R. Coal Agency, N. Y. City ... 594
Westmoreland Coal Company, Phila., Pa ... 593
J. & W. Wood, New York City ... 596

CANNEL COALS.

Perkins & Co., New York City ... 596
J. & W. Wood, New York City ... 596

ANTHRACITE COALS.

Coxe Bros. & Co., New York City ... 593

GAS ENRICHERS.

Standard Oil Co., Cleveland, ohio ... 599

BARROWS.

Grant McNeil, Akron, O ... 593

COKE CRUSHER.

C. M. Keller, Columbus, Ind ... 599

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y ... 593
Chapman Valve Manufacturing Co., Boston, Mass ... 593
R. D. Wood & Co., Phila., Pa ... 606
The P. H. & F. M. Roots Co., Connersville, Ind ... 596
Continental Iron Works, Brooklyn, N. Y ... 592

GAS ENGINES.

Schleicher, Schumm & Co., Phila., Pa ... 612
Clerk Gas Engine Co., Phila., Pa ... 609

ENGINES AND BOILERS.

Jarvis Engineering Co. Boston, Mass ... 599
Westinghouse Machin Co., Pittsburgh, Pa ... 601

GAS LAMPS.

Fiske, Coleman & Company, Boston, Mass ... 602

PURIFIER SCREENS.

John Cabot, New York City ... 593

GAS STOVES.

American Meter Co., New York and Philadelphia ... 595
The Goodwin Gas Stove and Meter Co., Phila., Pa ... 612
George M. Clark & Co., Chicago, Ills ... 593
Maryland Meter and Manufacturing Co., Baltimore, Md ... 610
Chicago Gas Stove Co., Chicago, Ills ... 591

BURNERS.

C. A. Gefrorer, Phila., Pa ... 591
Moses G. Wilder, Phila., Pa ... 591
H. W. Rappleye, Phila., Pa ... 599

STREET LAMPS.

J. G. Miner, Morrisania New York City ... 603
Bartlett Street Lamp Mfg. Co., New York City ... 603

PURIFYING MATERIAL.

Connelly Iron Sponge and Governor Co., New York City ... 599
Greenpoint Chemical Works, Brooklyn, N. Y ... 599

ELECTRICAL APPARATUS.

Wm. Henry White, N. Y. City ... 607
Fort Wayne Electric Co., Fort Wayne, Ind ... 600
Weston Electrical Instrument Co., Newark, N. J ... 591

ENGAGEMENT DESIRED,

As Superintendent or Manager of Gas Works.

By a young man of large experience in the manufacture and distribution of gas and the management of gas plant. All references. Address

855-tf "H. B.," care this Journal.

FOR SALE.

We have enlarged our works and now have for sale

Two Purifying Boxes,

8 x 8 x 3 ft., with center valve that is arranged so that one of two boxes can be used, or both can be bye-passed. We also have

A Gasholder,

65 ft. diameter and 20 feet deep, with columns and girders. The holder is in a fair state of preservation, and could be taken down and erected in some small city or town.

ST. JOSEPH GAS AND MFG. CO.,

855-tf K. M. Mitchell, Supt., St. Joseph, Mo.

WANTED,

A Small Gas Exhauster,

with 4 or 6 inch connections. Must be in good condition.

SANTA ANA GAS AND ELECTRIC CO.,

Santa Ana, Cal.

The Weston Standard

VOLTMETERS AND AMMETERS.

These Instruments are the most accurate, reliable, and sensitive portable instruments ever offered. A large variety of ranges, to meet the requirements of all kinds of work.

Send for Catalogue.

Weston Electrical Instrument Co.,

Office & Factory, 114-116 William St, Newark, N. J.

Special Trays for Iron Sponge or Oxide of Iron.

CHURCH'S TRAYS a Specialty.

Reversible, Strongest, Most Durable Most Easily Repaired.

306-310 Eleventh Avenue, New York.

We also make the Cheapest and strongest REVERSIBLE BOLTED TRAYS IN THE MARKET.

Send for Circulars.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

Not Expensive. Write to

STROH & OSIUS, Pat'ees, or Mich. Ammonia Works, Detroit, Mich.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

248 N. 8th St., Phila., Pa.

MOSES G. WILDER, MECH. ENGR.

816-18-20-22 Cherry St., Phila., Pa.

Volumetric Lamp Governors

FOR GAS LAMPS & HIGH-POWER BURNERS.

Governor Burners for Street Lamps & General Use

GOVERNORS FOR ARGAND AND OTHER COMMON GAS BURNERS IN ALL SIZES.

Horizontal Governors

Specially Adapted for Gas Stoves, Furnaces, etc.

It is well known that a large majority of all High Power Gas Lamps in the United States have my Governors attached, and they are always used by the leading makers of these lamps. To remove any excuse for the use by anyone of inferior and infringing Governors, a reduction in price has been made, and all exclusive contracts are cancelled.

Correspondence Solicited with all who require a Reliable Governor.

CHICAGO GAS STOVE COMPANY,

240-244 W. LAKE STREET, CHICAGO.

MANUFACTURERS OF ALL KINDS OF

GAS Cooking & Heating Appliances.

CHICAGO GAS STOVES TRADE MARK.

P. C. VAN WIE, Manager.

Reliable Gas Heaters

FINEST IN THE WORLD.

HANDSOME,
POWERFUL,
PROGRESSIVE

In Construction and Artistic in Design.

Offered in all styles and sizes of Illuminators or Asbestos Flame Plates.

GAS PARLOR GRATES = Beauties.

In Antique Bronze, Brass or Copper finish, or plain Black. Provided with Cold and Hot Air Return Flues.

✳ GREAT HEATERS. ✳

Fitted for any kind of gas.

Send for Catalog.

The SCHNEIDER & TRENKAMP CO.

CLEVELAND, OHIO.

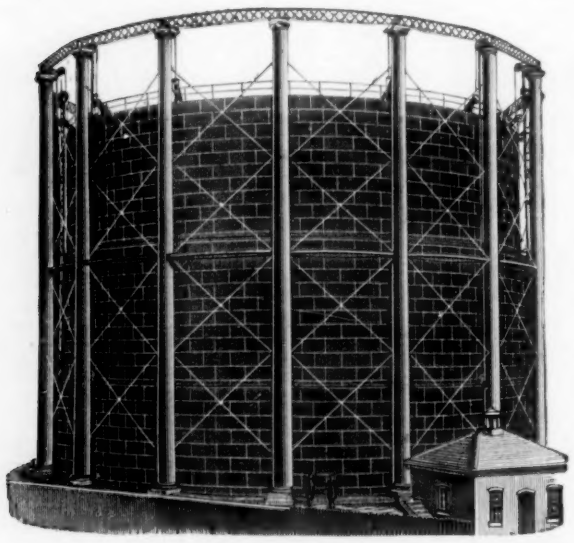
The Continental Iron Works

THOS. F. ROWLAND, President. THOS. F. ROWLAND, Jr., Secretary & Treasurer. WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.

Take East 10th or 23d St. Ferries from New York to Greenpoint.

BROOKLYN, N. Y.

BUILDERS OF



GAS HOLDERS,

SINGLE-LIFT and MULTIPLE-SECTION GAS HOLDERS A SPECIALTY.

Wrought Iron Gas Holder Tanks.

BENCH CASTINGS, RETORT LIDS,

Hydraulic Mains, Condensers, Scrubbers,

PURIFIERS, VALVES, Etc.

SELF-SEALING
Retort Mouthpieces and Lids.

For Round, Oval, or "D" Retorts.

McNEIL'S BALANCED CHARGING BARROW

For Coal or Coke. Best for charging or drawing hot Coke. Dumps on the floor. Can carry 1,500 lbs. with one man power.

STEEL WHEELBARROWS.

Best Barrows Ever Made.

Send for Catalogue.

GRANT McNEIL,
225 North Union Street,
AKRON, OHIO.

Meter Register.

Stamps the dials, pointers, and number of the meter on a card direct from the meter. Impossible for the meter reader to average statement or to make a mistake.

Send for Circular.

METER REGISTER CO., 52 Illinois Street, Chicago.

Coal Tar Genealogical Tree

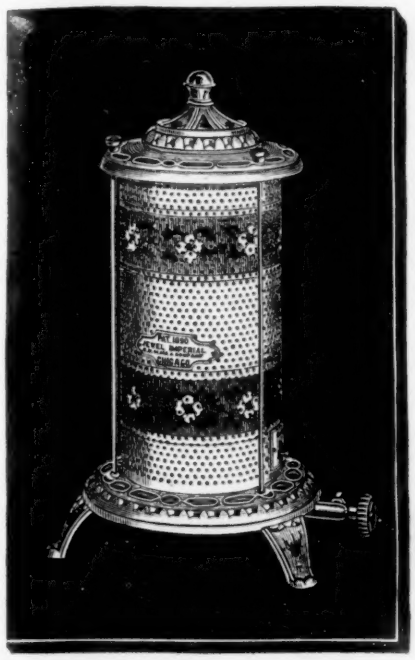
MR. T. VINER CLARKE, of London, Eng.

Having compiled a novel Chart or Map illustrating the various

CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,

In the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

A. M. CALLENDER & CO., No. 32 Pine Street, N. Y. City.



Jewel Gas Stoves

ARE THE BEST.

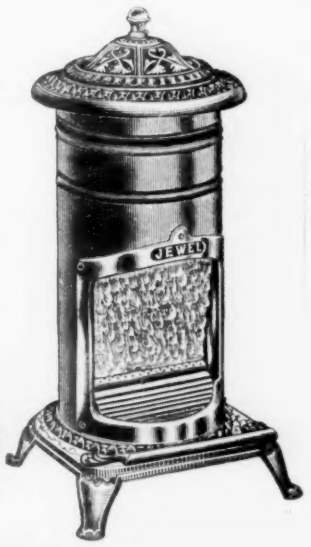
10 GAS HEATING STOVES,

Prices, from $4.50 to $16.50.

55 GAS COOKING STOVES,

Prices, from 75 Cents to $65.00.

Send for Catalogs and Discount.



GEORGE M. CLARK & COMPANY,

MAKERS,

157-161 Superior St., Chicago.

CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

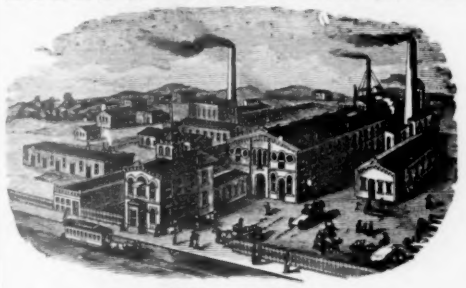
Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants With and Without Independent Nozzle Valve. All Work Guaranteed.

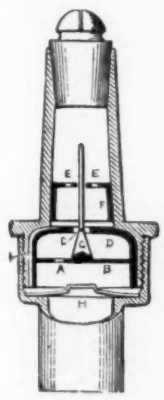
WORKS & GEN'L OFFICE: **Indian Orchard, Mass.**

TREASURER'S OFFICE: **72 Kilby & 112 Milk Sts, Boston, Mass.**

LUDLOW VALVE MFG. CO.



OFFICE AND WORKS,
938 to 954 River Street and 67 to 83 Vail Av., TROY, N. Y.



Rappleye's Rheometric Governor Burner.

Free Sample and Special Price to Gas Light Companies.

MACON GAS LIGHT AND WATER COMPANY,
MACON, GA., March 22, 1889.

Dear Sir—Replying to your inquiry of March 19, would say that I have been using your Rheometric Governor Burners since 1885, and am very well pleased with the results obtained from them. For the price charged they are the best Governor Burners I have tried, and seem to keep up the standard from year to year. Yours very truly, A. E. BOARDMAN, Sec. & Treas.

H. W. RAPPLEYE, 2814 Poplar St., Phila., Pa.

Hydraulic Main Lip Regulators, also Check Valves, Foot Valves, Yard-wash and Fire Hydrants.

Send for Circulars.

Valves.—Double and Single Gate, ½ in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil. Send for Circulars.

Standard Oil Company,

GAS NAPTHA DEPARTMENT OF THE WEST.

GAS NAPTHA.

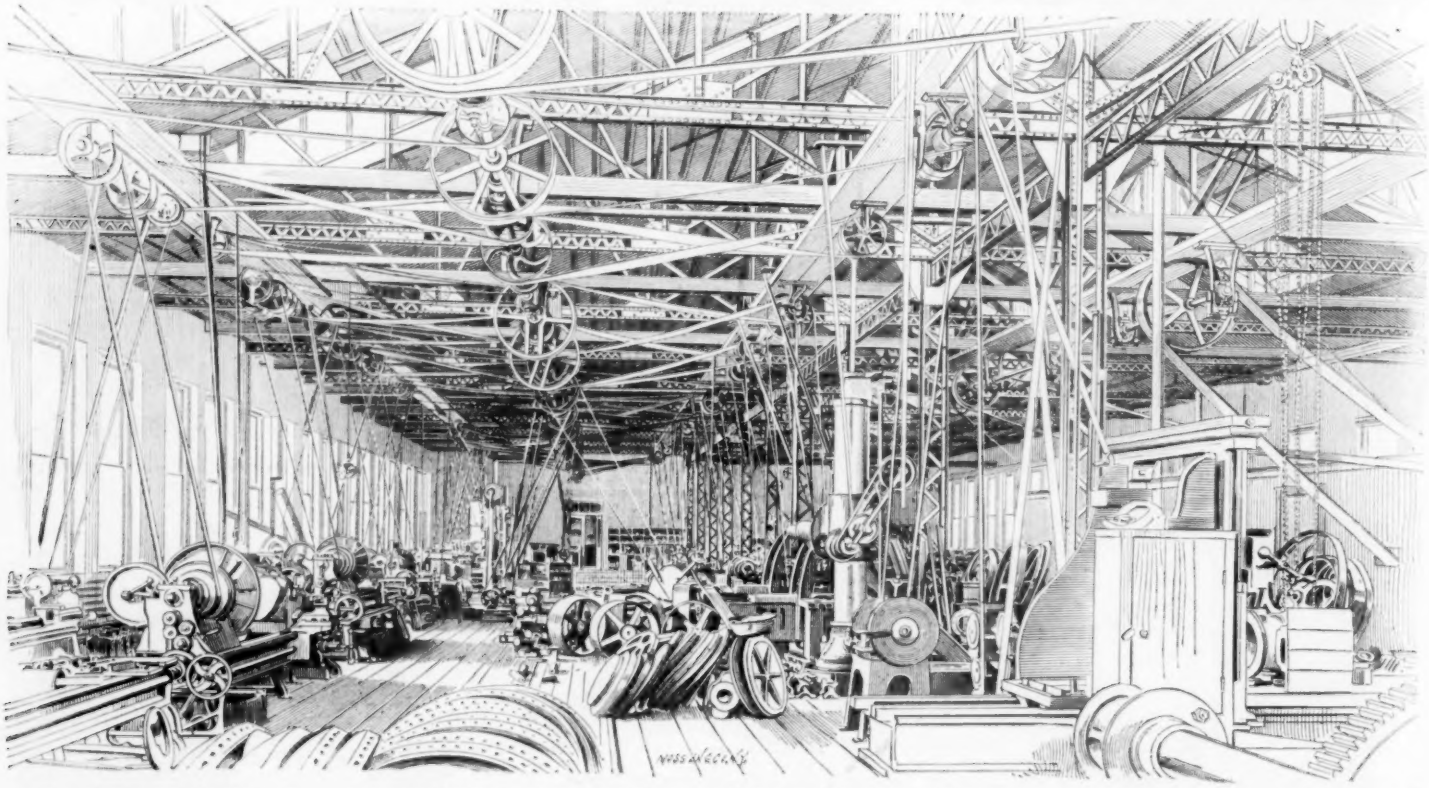
GAS OIL.

Correspondence Solicited.

CLEVELAND, OHIO.

CHAS. M. JARVIS, Prest. & Chief Engineer. BURR K. FIELD, Vice-President. FRANK L. WILCOX, Treasurer. GEO. H. SAGE, Secretary.

THE BERLIN IRON BRIDGE CO.



The above illustration shows the construction of an iron truss roof designed and built by us over the Machine Shop for the Titusville Iron Company, Titusville, Pa. The building is 70 ft. in width by 205 ft. in length, the iron roof trusses being arranged to carry shafting. *Write for Illustrated Catalogue.*

Office and Works, EAST BERLIN, CONN.

GASHOLDER PAINT.

Use Only

THE GOVERNMENT WATERPROOF PAINT.

Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

THE GOVERNMENT WATERPROOF PAINT CO., 122 Milk Street, Boston, Mass

Fuel and Its Applications

By E. J. MILLS, D.Sc. F.R.S., and F. J. ROWAN, C.E., assisted by others, including Mr. F. P. Dewey, of the Smithsonian Inst., Wash., D. C.

7 PLATES, AND 607 OTHER ILLUSTRATIONS. ROYAL OCTAVO, PAGES XX, 802. HANDSOME CLOTH, $7.50.

A. M. CALLENDER & CO., 32 Pine St., N. Y.

Water Gas! Fuel Gas!

For all Manufacturing Purposes. Generated from Bituminous Slack, Anthracite Coal Dust, or Coke Breeze, by

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Sons' Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Utilizing any Kind of Low-Priced Coals.

NOVEL IN DESIGN, MODERN IN CONSTRUCTION, SIMPLE IN OPERATION, PERFECT IN RESULTS.

Plans and Estimates Furnished.

BURDETT LOOMIS, - - Hartford, Conn.,

Or Murray Hill Hotel, New York City.

King's Treatise on Coal Gas.

In Three Volumes. Price per Vol., $10. Sold either by Volume or in Sets.

A Standard text-book for the Engineers and Managers of Gas Works, and for all who are concerned or take an interest in the manufacture and distribution of Coal Gas, and in the utilization of the Secondary Products resulting therefrom; treating also of the Gas Engine and of Gas Cooking and Heating Appliances.

A. M. CALLENDER & CO., 32 Pine Street, N. Y. City.

GAS STOVES. GAS METERS. GAS STOVES.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

MANUFACTURERS OF

Standard 3 Diaphragm Dry Meter.

Gas Meters,

STATION METERS,

METER PROVERS, PHOTOMETERS,

Experimental Meters of all Kinds,

AND

Standard 2 Diaphragm Dry Meter.

Apparatus for Testing the Quantity and Quality of Gases.

Meters for Measuring Natural Gas.

MANUFACTORIES,

508 to 514 West Twenty-second St., N. Y. Arch and Twenty-second St., Phila.

Nos. 244 & 246 North Wells Street, Chicago, Ill.

AGENCIES,

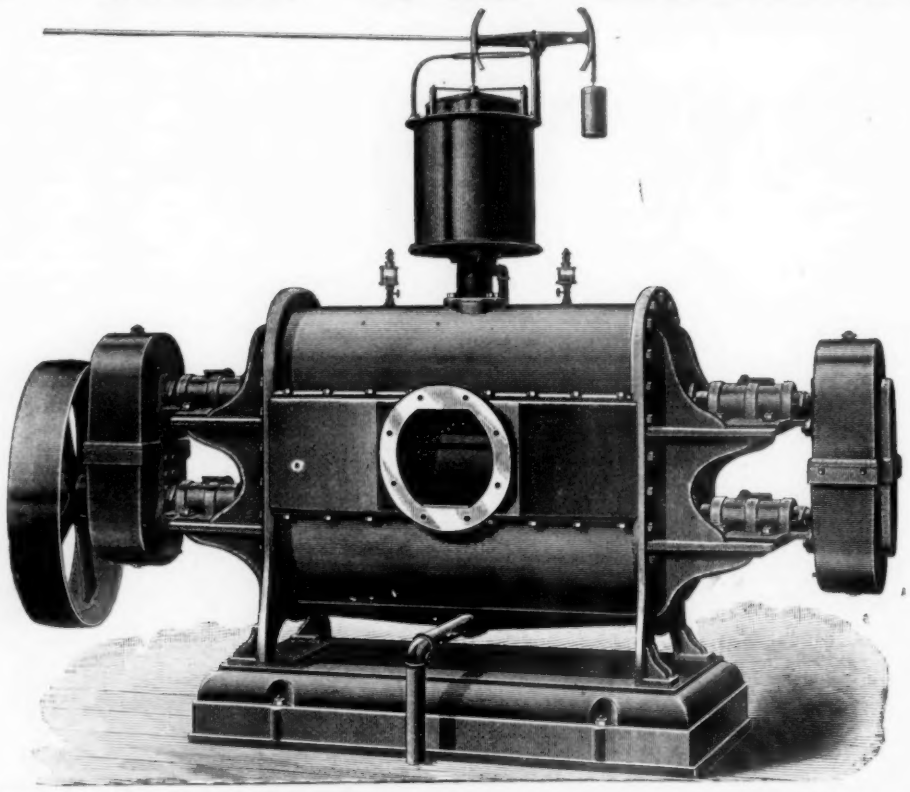
No. 177 Elm Street, Cincinnati, Ohio. No. 222 Sutter Street, San Francisco, Cal.

No. 810 North Second Street, St. Louis, Mo.

GAS STOVE SHOW ROOMS, No. 242 Sixth Avenue, New York City.

ROOTS' NEW GAS EXHAUSTER.

Unsurpassed for Neatness of Design, Durability, Simplicity, Efficiency, and Economy of Power.



All Parts Requiring Attention are External and Easily Accessible at all Times.

Send for Descriptive Catalogue and Price List.

THE P. H. & F. M. ROOTS CO., Patentees and Manufacturers, **CONNERSVILLE, IND.**

S. S. TOWNSEND, Gen. Agts., COOKE & CO., Selling Agts., 163 & 165 Washington St., N. Y.

THE WALKER TAR AND CARBONIC ACID EXTRACTOR.

A very general demand exists, in both large and small Gas Works, for an apparatus that will be absolutely efficient in the removal of the Tar which passes the hydraulic main and condenser. Many attempts have been made to accomplish this, but, I believe, without success, until the introduction, six years ago, in England, of the C. & W. Walker Patent Tar and Carbonic Acid Extractor. During these years this apparatus has been adopted by many of the most prominent Engineers, not only in England, but also on the Continent of Europe and in other parts of the world. Several have been erected in the United States.

"The C. & W. Walker Tar and Carbonic Acid Extractor has been in operation at these works for the past six weeks, and is an unqualified success. It removes every particle of Tar from the gas in once passing through the apparatus, and a large percentage of the Carbonic Acid. I also feel quite sure that it prevents the formation and deposit of Naphthaline, because since I started the Washer I have had no stoppages from this cause. These works have been seriously troubled with Tar for many years, and I have used several kinds of apparatus and every expedient which has come to my attention for dealing with the difficulty, but without success. The Walker apparatus occupies comparatively small space, is less expensive than other systems, and requires but little attention. I carry 2½-inch seal, and have an automatic tar delivery valve. This Tar Extractor is indispensable to gas makers.

"C. A. GERDENIER, Supt. Bridgeport (Conn.) Gas Lt. Co."

This Tar Extractor will perform its work with about one-fourth the usual back-pressure heretofore required. It is simple in construction, and can be supplied at a very reasonable price—less than any other ever before introduced. Satisfactory results guaranteed in every instance.

GEO. SHEPARD PAGE, Sole Agt. for the U. S., 69 Wall Street, N. Y. City.

SCIENTIFIC BOOKS.

KING'S TREATISE ON THE MANUFACTURE OF COAL GAS. Three vols.; $10 per vol.

GAS MANUFACTURE, by WILLIAM RICHARDS. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

TECHNICAL GAS ANALYSIS. $2.80.

GAS CONSUMER'S GUIDE. $1.

GAS MEASUREMENT AND GAS METER TESTING, by F. W. HARTLEY. $1.60.

GAS CONSUMER'S HANDBOOK, by WILLIAM RICHARDS, C.E.; 18mo., Sewed. 20 cents.

A PRACTICAL TREATISE ON GAS AND VENTILATION with Special Relation to Illuminating, Heating, and Cooking by Gas, by E. E. PERKINS. $1.25.

CHEMISTRY OF ILLUMINATING GAS, by NORTON H. HUMPHRYS. $2.40.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

STRAINS IN IRONWORK, by H. ADAMS. With plates. $1.75.

GAS WORKS—THEIR ARRANGEMENT, CONSTRUCTION, PLANT, AND MACHINERY. $8.

COAL; ITS HISTORY AND USE, by PROF. THORPE. $3.50.

THE GAS WORKS OF LONDON, by COLBURN. 60 cents.

HEAT A MODE OF MOTION, by JOHN TYNDALL. $2.50.

MUNICIPAL LIGHTING, by F. H. WHIPPLE. $1.

GAS WORKS, AND MANUFACTURING COAL GAS, HUGHES. $2.20.

THE MANAGEMENT OF SMALL GAS WORKS, by C. J. R. HUMPHREYS. $1.

MANUAL FOR GAS ENGINEERING STUDENTS, by D. LEE, 40 cents.

THEORY OF HEAT, by J. CLERK-MAXWELL. $1.25.

THE DOMESTIC USES OF COAL GAS, AS APPLIED TO LIGHTING, by W. SUGG. $1.40.

DIGEST OF GAS LAW. $5.

DISTLLATION OF COAL TAR AND AMMONIACAL LIQUOR, by GEO. LUNGE. New Edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS, by D. A. GRAHAM 8vo., Cloth. $3.

GAS COMPANIES DIRECTORY, 1891. $5.

THE AMERICAN GAS ENGINEER AND SUPERINTENDENT'S HANDBOOK, by WM. MOONEY. $3.

GAS ENGINE INDICATOR DIAGRAM, by W. E. AYRTON. Paper. 20 cents.

ILLUMINATING AND HEATING GA , by W. BURNS. $1.50.

TESTING PIPES AND PIPE JOINTS, by M. M. PATERSON. 80 cents.

DESIGNING WROUGHT AND CAST IRON WORK, by H. ADAMS. Paper. Three parts, 60 cents each.

NOTES IN MECHANICAL ENGINEERING, by H. ADAMS. $1.

The above will be forwarded by express, upon receipt of price. If sent by mail, postage must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order.

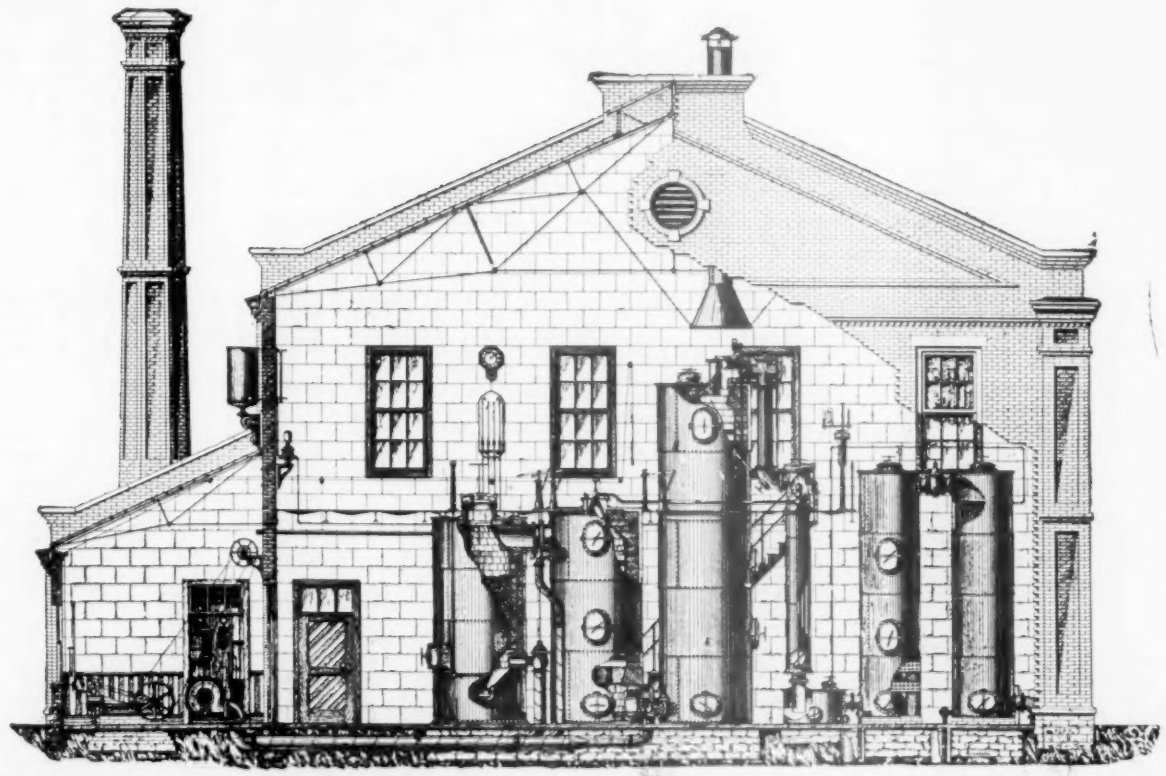
A. M. CALLENDER & CO., 32 Pine Street, New York.

THE UNITED GAS IMPROVEMENT CO.,

DREXEL BUILDING, PHILA., PA.

Owners of the Lowe, Granger-Collins, McKay-Critchlow (for carbureting Natural Gas), and Other Gas Patents.

BUILDERS, LESSEES and PURCHASERS OF GAS WORKS.



Standard "Double Superheater" Lowe Apparatus, Especially Designed for the Use of Lima Crude Oil.

Erectors of

WATER GAS PLANTS,

(Either Independent or Auxiliary to Coal Gas Works),

USING LIMA OR OTHER LOW GRADE OILS AND ANTHRACITE COAL OR GAS HOUSE OR OVEN COKE

PAMPHLETS, PLANS, AND ESTIMATES FURNISHED UPON APPLICATION.

NATIONAL
GAS LIGHT AND FUEL CO.,

No. 52 Lake Street, Chicago.

FRED'K H. SHELTON, Manager.

GAS WORKS

Built, Remodeled, Leased, or Purchased.

THE SPRINCER CUPOLA SYSTEM.

Also, by Special Arrangement with the United Gas Improvement Company,

AGENTS FOR THE WEST

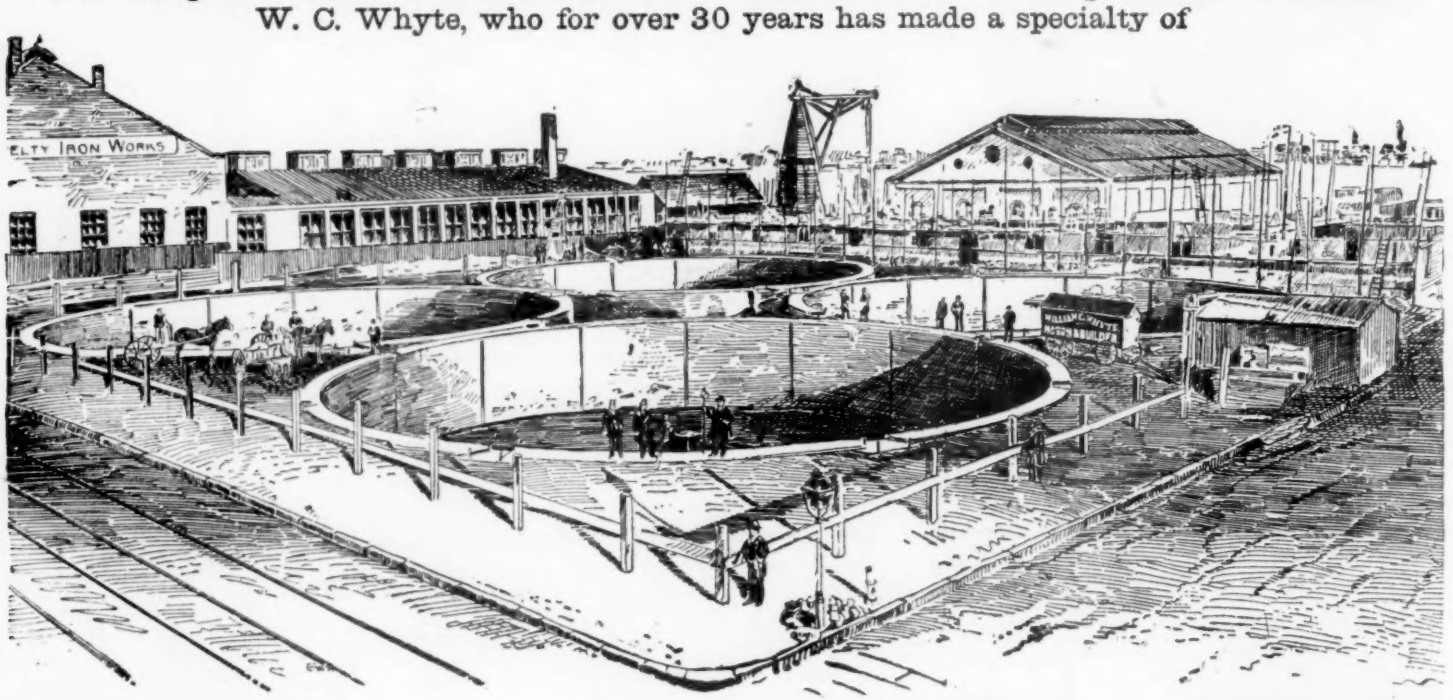
FOR THE "DOUBLE-SUPERHEATER," "JUNIOR," AND OTHER FORMS OF THE

Lowe Water Gas Apparatus.

Full Information Furnished upon Application.

GASHOLDER TANK CONSTRUCTION, ETC.

Gas Companies and others about to erect Gasholders will find it profitable to consult W. C. Whyte, who for over 30 years has made a specialty of



Tank Excavation and Mason Work.

Fifty Tanks now in operation show the sort of work done. Address

W. C. WHYTE, - No. 15 Cortlandt Street, N. Y. City.

WHAT OUR CUSTOMERS SAY OF IRON SPONGE.

COLUMBUS, O. I regard the Connelly Iron Sponge as the best form of oxide of iron of which I have any knowledge.
E. McMILLIN, Eng'r.

OHIO PENITENTIARY, I take pleasure in saying that the Iron Sponge bought of you two years ago, and which has been in constant use ever since, has given entire satisfaction. It does all you claim for it; in fact it reduces the cost of purifying to almost nothing—which certainly ought to be satisfactory. R. P. GREEN, Supt.

CINCINNATI, O. Our experience shows that by the use of Iron Sponge in place of lime we have effected a saving of 1.4 cents per M. in cost of purification. A. HICKENLOOPER, Prest.

SANDUSKY, O. The Iron Sponge has been a great advantage and saving to us over old method. THOS WOOD, Supt.

CADIZ, O. We have been using your Sponge for five years with entire satisfaction, and at about one-fourth the cost when we used lime for purification. A. N. HAMMOND, Supt.

LOGAN O. We have no desire to go back to purification by lime.
A. MICHIE, Sec.

LIMA, O. We have used your Iron Sponge for two years, nothing else, and are entirely satisfied with it. LIMA GAS LT. CO.

TROY, O. Recommend Iron Sponge to any Gas Company. It is as good and far cheaper than lime, and far less labor connected with it. R. A. DITTMAR, Supt.

WOOSTER, O. We have used your Iron Sponge about 8 months with entire satisfaction, and we shall continue to use it as long as we can do so with the success we have had thus far.
WOOSTER GAS LT. CO.

HAMILTON, O. We have been using your Iron Sponge for the past 5 years exclusively—using no lime with it—and it affords us pleasure to testify to its merits. Our present lot has been in use now over 16 months. D. H. HENSLEY, Sec.

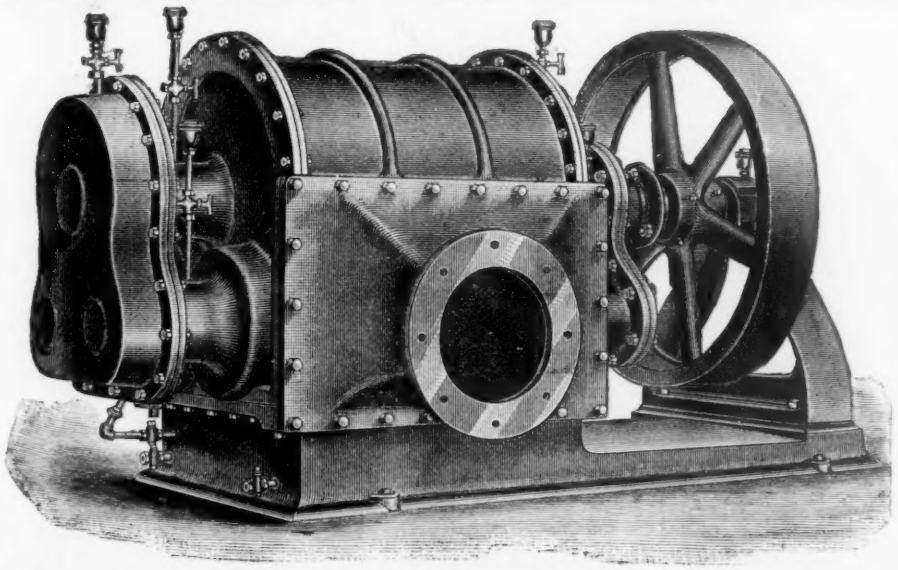
MANSFIELD, O. Our Company has been using your Iron Sponge for 2 years in our works for purifying. It has been very satisfactory, and we would not know how to get along without its use.
G. S. HARRIS, Supt.

PORTSMOUTH, O. We have been using your Iron Sponge, and so far *it has given entire satisfaction.* J. W. SMITH, Sec.

PAINESVILLE, O. We have used your Iron Sponge for the past 2 years, and shall continue to use it. *It gives perfect satisfaction.* J. W. ALEXANDER, Prest.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 111 Broadway, New York.

WILBRAHAM GAS EXHAUSTER



WILBRAHAM BROS.,
PHILADELPHIA, PA.

IRON MASS
For Gas Purification.
Acts immediately, and more efficiently than any other purifying agent now in use.

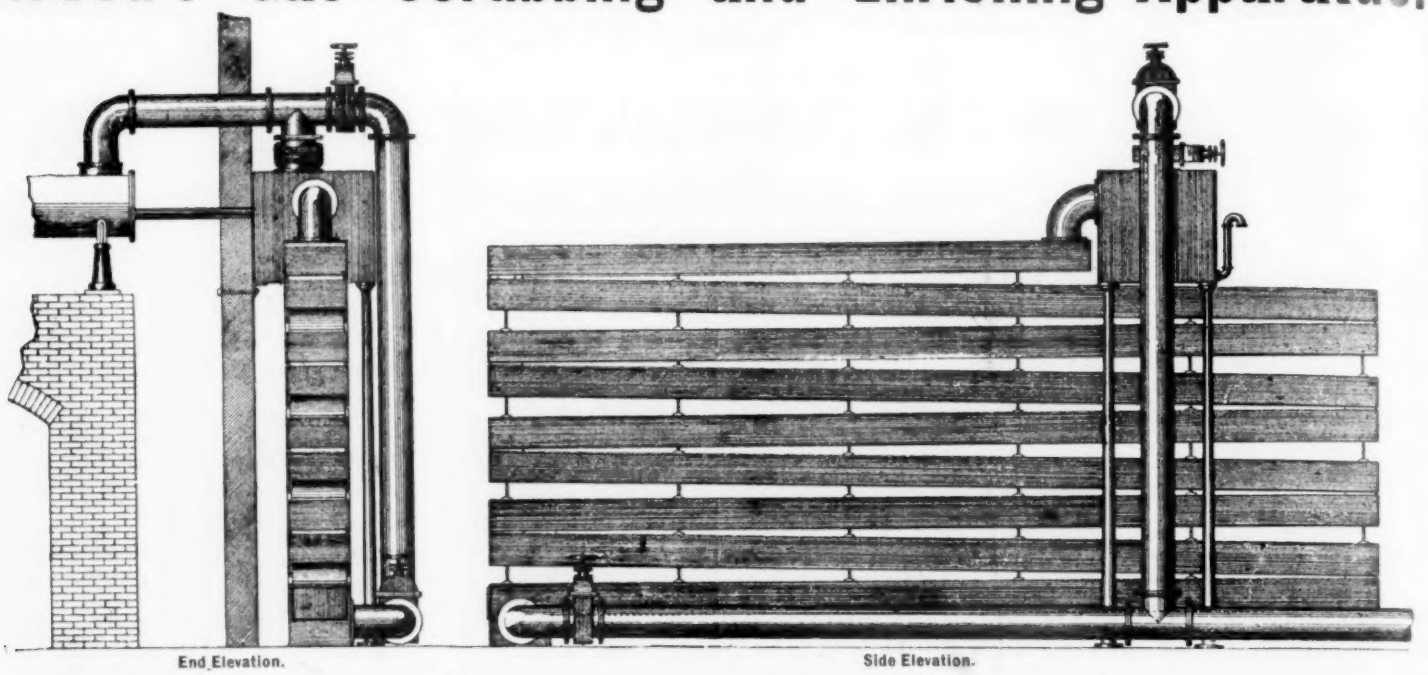
Greenpoint Chemical Works.
JOHN SCHRIEVER, Manager.
Greenpoint Ave. & Newtown Creek, Brooklyn N.Y.

JARVIS ENGINEERING CO.,
61 Oliver St., Boston, Mass.
CONTRACTORS FOR ERECTING
COMPLETE STEAM OUTFITS FOR ELECTRIC LIGHTING STATIONS.
Steel Boilers set with Jarvis Pat. Boiler Setting
To burn **COKE SCREENINGS** for Fuel.
ARMINGTON & SIMS CO. ENGINES,
Belting direct to Dynamos, without using Shafting.
SEND FOR CIRCULARS.
REFERENCES.—Charlestown Gas & Electric Light Co., Charlestown, Mass.; Schenectady Gas & Electric Light Co., Schenectady N. Y.; Brookline Gas Co., Brookline, Mass.

Gasholder Tanks & Gas Works Masonry Complete.
PLANS PREPARED AND ESTIMATES FURNISHED AT SHORT NOTICE.
J. P. WHITTIER, 70 Rush St., near Division Av., Brooklyn, N. Y.
A Large Quantity of Ground Fire Brick For Sale Cheap.

1891 DIRECTORY 1891
OF AMERICAN GAS COMPANIES.
Price, - - - - - - - - $5.00.
A. M. CALLENDER & CO., No. 32 Pine Street, New York City.

Wood's Gas Scrubbing and Enriching Apparatus.



End Elevation. Side Elevation.

The cheapest, simplest, and most effective apparatus for removing Tar and Ammonia, and enriching Gas, ever brought to the attention of Gas Manufacturers. With ordinary condensers and scrubbers the condensable illuminants flow off to the tar wells and liquor tanks and are lost, but with Wood's Apparatus these illuminants are saved and retained in the gas, thus increasing its illuminating power and making a great saving in the cost of enriching material. Where set up next after the Hydraulic main, this Scrubber produces an 8-oz. Ammoniacal Liquor.

JAMES R. FLOYD & SONS, - - Nos. 531 to 543 West 20th Street, N. Y. City.

FORT WAYNE ELECTRIC CO.

FORT WAYNE, IND.

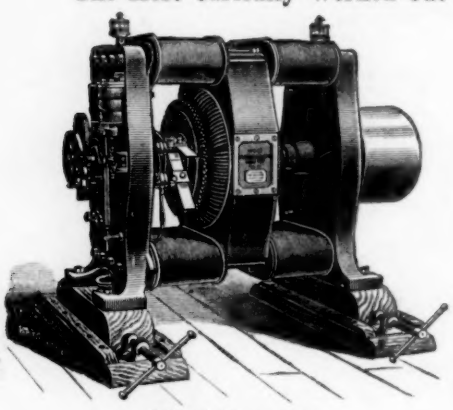
MANUFACTURERS OF THE

Slattery Induction System

—OF—

LONG DISTANCE INCANDESCENT LIGHTING.

The Most Carefully Worked Out and Complete Alternating Current System of Electric Lighting in Existence.



Wood Dynamo.

—AND THE—

WOOD

Automatically Regulating

ARC DYNAMOS AND LAMPS.

Main Office and Factory, Fort Wayne, Ind.

BRANCH OFFICES.

NEW YORK, - - - 115 Broadway.
PHILADELPHIA, - - 907 Filbert Street.
CHICAGO, - - - 185 Dearborn Street.
SAN FRANCISCO, 35 New Montgomery Street.
BUFFALO, N. Y. - - 228 Pearl Srteet.
PITTSBURCH, PA., - - 533 Wood Street.
DALLAS, TEXAS, - - - McLeod Building.
TORONTO, CANADA, - 138 King Street, West.
MEXICO, F Adams' Successors, - City of Mexico.
CUBA, Maicas & CO., - - - Havana.

ENGINEERS.

P. D. WANNER, Chairman. A. H. MELLERT, Mangr. of Wks.
R. B. KINSEY, Secretary. F. A. KNOPP, Treasurer.

MELLERT FOUNDRY & MACHINE CO. Ltd.
and READING FOUNDRY CO., Ltd.

Reading, Pa.

Specials—Flange Pipe, Valves and Hydrants Lamp Posts, Retorts, etc.

General Foundry and Machine Work.

JOHN FOX, Selling Agent. **160 Broadway, N.Y.**

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

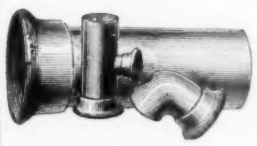
Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS.

Columbus, Ohio.

GAS AND WATER PIPES.

WARREN FOUNDRY AND MACHINE CO.,



Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

GAS AND WATER PIPES.

M. J. DRUMMOND,

SPECIAL CASTINGS AND LAMP POSTS.

Office, Corbin Building, 192 Broadway, N. Y.

GAS AND WATER PIPES.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

THE ADDYSTON PIPE AND STEEL COMPANY.

CAST IRON **CINCINNATI, OHIO.**

PIPE FOR MANUFACTURED AND NATURAL GAS AND WATER.

SPECIALS, FLANGE PIPE, AND LAMP POSTS

JOS. R. THOMAS,

No. 32 Pine Street, N.Y. City.

CONSULTING AND CONSTRUCTING

Gas Engineer and Contractor.

PLANS, SPECIFICATIONS, AND ESTIMATES FURNISHED.

Contracts taken for all Appliances required at a Gas Works,

Either for New Works or Extensions to Old Plants.

JAMES R. SMEDBERG,

Gas Engineer,

213 Jefferson Ave., Peoria, Ill.,

Will furnish Plans, Specifications and Estimates for the Remodeling or extension of Gas Works. Also, Analytic Reports upon the business condition and prospects of Gas Companies. Ample references will be given.

DURAND WOODMAN, Ph.D.,

Analytic and Technical

CHEMIST.

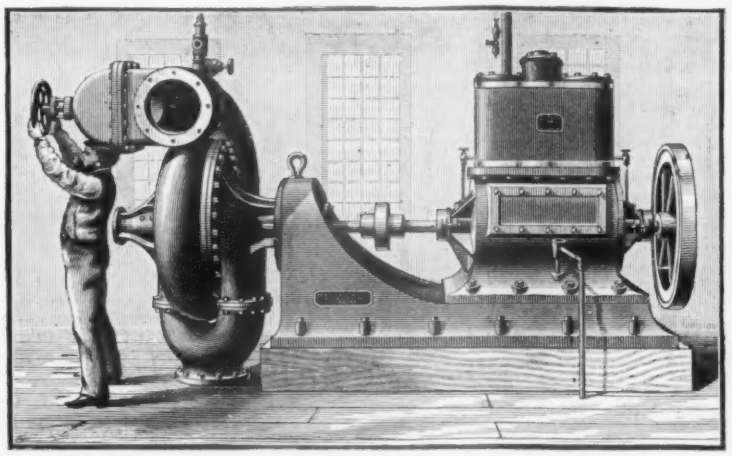
Analyses of Gas, Fuel and Gas Coals, Crude and Refined Petroleum, Materials for Gas Purification, Tar, Ammoniacal Liquors and other Bye-Products, Fire Clays, Deposits in Mains, Water for Steam Making, Boiler Scale, etc., etc. Expert work in connection with "Damages to adjacent water supplies and adjoining properties." Experimental Investigations for Inventors.

127 Pearl Street (Hanover Square), N. Y.

WESTINGHOUSE ENGINES

A SAMPLE INSTALLATION.

Standard Automatic Engine coupled direct to a Centrifugal Pump. Speed 280 Revolutions.



Over 4000 Westinghouse Standard Engines in use.

THE WESTINGHOUSE MACHINE COMPANY.
BARNETT & CO. N.Y. **PITTSBURGH, PENNA. U.S. OF A.**

RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK.

J. H. GAUTIER & COMPANY

CORNER OF

GREENE AND ESSEX STREETS,

JERSEY CITY, N. J.

MANUFACTURERS OF

Clay Gas Retorts,

Gas House Tiles,

Fire Bricks, Etc. Etc.

Ground Clay, Fire Brick and Fire Sand in Barrels,

H. GAUTIER, Prest. CHAS. E. GAUTIER, Sec. & Treas.
CHAS. E. GREGORY, V.-Prest. DAVID R. DALY Gen'l Mang'r.

BROOKLYN

Clay Retort & Fire Brick Works,

(EDWARD D. WHITE & CO.)

Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.

VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.

Office, 88 Van Dyke St., Brooklyn, N. Y.

LACLEDE FIRE BRICK MFG. CO.,

MANUFACTURERS OF

Fire Brick, Gas Retorts,

AND

ST. LOUIS STANDARD SEWER PIPE.

Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.

OFFICE AND DEPOT

901, 903, and 905 Pine Street,

ST. LOUIS, MO.

ESTABLISHED IN 1845.

B. KREISCHER & SONS,

OFFICE FOOT OF HOUSTON ST., E.R., N.Y.

Gas Retorts,

TILES, FIRE BRICK.

AND EVERYTHING IN THE FIRE CLAY LINE.

MANHATTAN

FIRE BRICK & ENAMELLED CLAY

RETORT WORKS

ADAM WEBER.

CLAY GAS RETORTS AND RETORT SETTINGS

FIRE BRICKS, TILES, ETC.,

Office and Works, 15th Street and Avenue C., N. Y

Works, LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Successor to WILLIAM GARDNER & SON.

Office, Rooms 19 & 20, Lewis Block PITTSBURGH, PA, P. O. Box 373

Fire Clay Goods for Gas Works.

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

H. A. NORTON, No. 92 WATER STREET, BOSTON, MASS., Agent for the New England States.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.

OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

PRICE LIST.

In Casks, 600 to 800 lbs., f.o.b. N. Y., at 5 cents per pound.
In Kegs, 100 to 300 lbs., " " at 6 " "
In Kegs less than 100 lbs., " " at 7 " "

C. L. GEROULD & CO.,

5 & 7 Skillman St., Brooklyn, N. Y.

Western Agt., H. T. GEROULD, Jeffersonville, Ind.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,

Mermod-Jaccard Bldg., Rooms 307 & 308, Broadway & Locust St., St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We have the *exclusive Agency for the West* of the celebrated

Kloenne-Bredel Full Depth and Semi-Recuperator Benches,

And also furnish and build

Our Own Styles Semi-Recuperator Furnaces for the use of Coal or Crude Petroleum fuel.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Supt.

BALTIMORE RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY,

AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.

WALDO BROS., 88 WATER ST., BOSTON, MASS

Sole Agents the New England States.

Boston Fire Brick Works Manufacturers of **Gas Retorts and Settings**

Under the Personal Supervision of MR. GEO. C. HICKS late of Chicago.

Fire Clay Goods of all kinds. Akron Sewer Pipe, Lime, Cement, etc. Agts. for the Arc Gas Lamp & Governing Gas Burners.

Send for Circulars and Prices to

FISKE, COLEMAN & CO., Managers, No. 62 Congress Street, Boston, Mass

FRED. BREDEL, C. E.,

Contractor for the Complete Erection and Equipment of Gas Works.

Sole Proprietor of the KLOENNE PATENTS for North America.

Gas Condensing and Purifying Machine.

Doing all the Work Between Exhauster & Oxide Purifier.

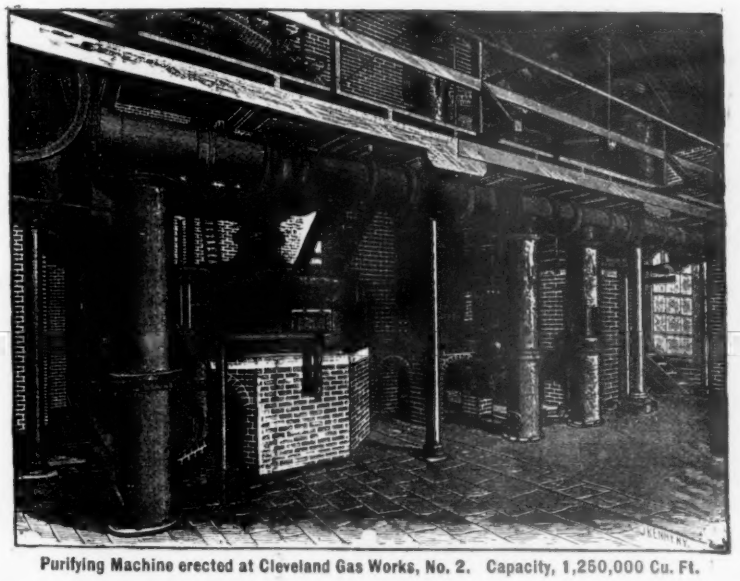
No Condensers Required.

No Naphthaline or Pitch is Formed.

HIGHER CANDLE POWER.

Tar & Ammonia Washers

WATER GAS WASHERS.



Purifying Machine erected at Cleveland Gas Works, No. 2. Capacity, 1,250,000 Cu. Ft.

RECUPERATIVE FURNACES.

Adapted to Retort Houses With or Without Stage Level.

Over 1,400 Retorts Now in Use in America.

Inclined Retort Benches.

Refers, by permission, to Mr. Eugene Vanderpool, Newark, N. J., and Mr. E. G. Cowdery, Milwaukee, Wis.

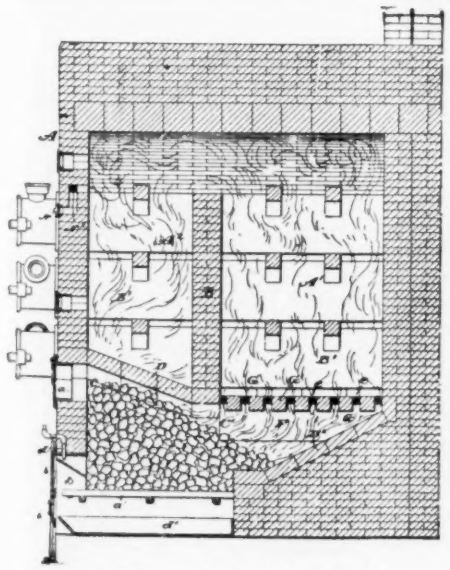
For further information address

FRED. BREDEL,

118 Farwell Ave., Milwaukee, Wis. 22 Beaver St., N. Y. City.

FLEMMING'S

Generator-Gas Furnace



Materials furnished and Benches erected by

J. H. GAUTIER & CO., - Jersey City, N. J.

(Address as above, or D. O. FLEMMING, Jersey City, N. J.

AMERICAN GAS LIGHT JOURNAL

$3.00 per Annum.

A. M. CALLENDER & CO.,

32 Pine Street, N. Y.

The Miner Street Lamps.

Jacob G. Miner,

No. 823 Eagle Ave., New York, N. Y.

Bartlett Street Lamp Mfg. Co.

MANUFACTURERS OF

Globe Lamps,

FOR

Streets, Parks, Public Buildings, Railroad Stations, etc.

LAMP POSTS

A Specialty.

Office and Salesroom,

40 & 42 COLLEGE PLACE, - - N. Y. CITY.

Gas Companies and others intending to erect Lamps and Posts will do well to communicate with us.

The American Gas Engineer and Superintendent's Handbook.

By WM. MOONEY.

350 Pages, Full Gilt Morocco. Price. $3.00.

A. M. CALLLENDER & CO., 32 Pine St., N. Y.

DAVIS & FARNUM MFG. CO.,

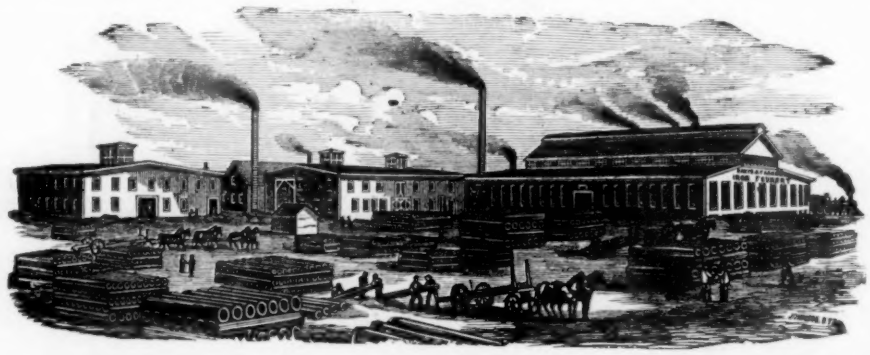
WALTHAM, MASS.

PRINCIPAL OFFICE AND WORKS, Waltham, Mass. BOSTON OFFICE, Room 18, Vulcan Building, 8 Oliver Street.

SINGLE, DOUBLE, AND TRIPLE LIFT

Gasholders.

OF ANY CAPACITY.



TUBULAR, PIPE, AND SINUOUS FRICTION

Condensers.

OF ALL SIZES.

IRON ROOF FRAMES AND FLOORS.

Purifying Boxes, Center Seal or Valve Connections, Bench Work.

Reversible Lime Trays.

SELF-SEALING AND PRESSED STEEL MOUTHPIECE LIDS.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Plant.

— ALSO —

Gas and Water Pipe, Flanged Pipe,

Sugar House Work, and Special Castings of all Descriptions.

Established 1861. Incorporated 1881.

KERR MURRAY MFG. CO.,

FORT WAYNE, IND.

Those who are in need of

Holders or Gas Works Apparatus of any Description,

AND OF THE LATEST IMPROVEMENTS,

will find it to their interest to

GET AN ESTIMATE FROM US

before placing their order.

As we make a Specialty of this Class of Work, and are Practical Builders and Manufacturers of same,

with our long years of experience in the business,

WE CAN GUARANTEE YOU SATISFACTION.

Estimates, Plans and Specifications Furnished on Application.

BARTLETT, HAYWARD & CO.

Baltimore, Md.

Triple Double, & Single-Lift

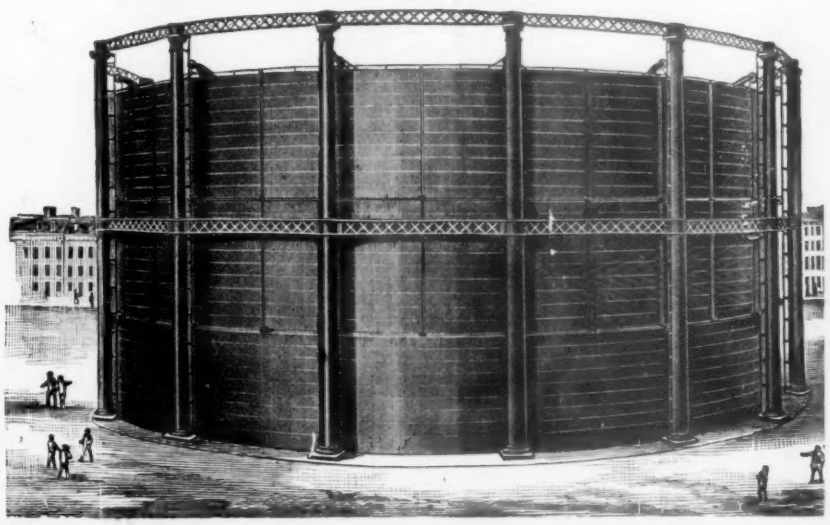
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS.



PURIFIERS.

CONDENSERS.

Scrubbers.

BENCH CASTINGS

OIL STORAGE TANKS.

Boilers.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

Munich Regenerative Furnace, System Drs. Schilling & Bunte.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

Pascal Iron Works. ESTABLISHED 1821. Delaware Iron Works.

MORRIS, TASKER & CO.,

INCORPORATED.

OFFICE, 224 SOUTH THIRD STREET, - - PHILADELPHIA, PA.

CONTRACTORS, BUILDERS, AND MANUFACTURERS OF

Gas, Water & Sugar Works

Bench Castings.

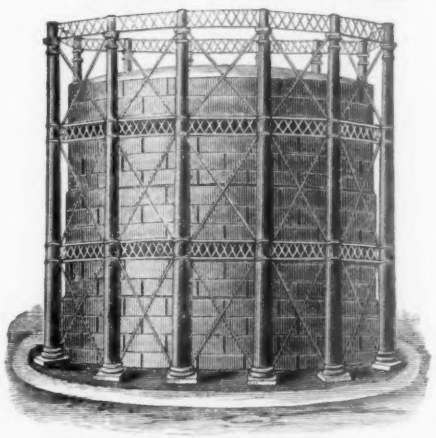
Condensers.

Scrubbers.

Purifiers.

Hyd. Carriages.

Iron Floors,



Iron Roofs.

Street Stops,

Valves, etc.

Stand-Pipes.

Water & Oil

Tanks, all Sizes.

Single, Double, and Triple-Lift Gas Holders.

SELF-SEALING RETORT LIDS. STAMPED STEEL RETORT LIDS.

Locomotive Water Columns, Filters, etc. Boiler Tubes, Wrought Iron Pipe & Fittings.

Plans, Specifications and Estimates for all kinds of Machinery furnished on application.

Foundries & Works,
MILLVILLE, FLORENCE,
and CAMDEN, N. J.

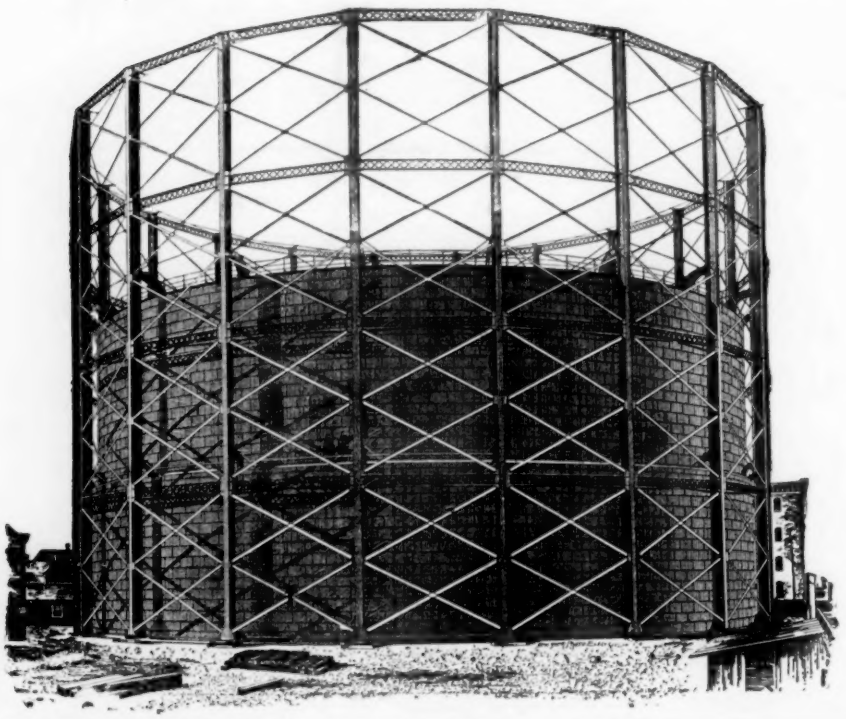
R. D. WOOD & CO.,

Engineers,
Iron Founders,
and
Machinists.

400 Chestnut St., PHILADELPHIA, PA.

MANUFACTURERS OF

CAST IRON PIPE,



Gas Holders,

SINGLE, DOUBLE, AND TRIPLE LIFTS, WITH
OR WITHOUT WROUGHT IRON
OR STEEL TANKS.

PURIFIERS, CONDENSERS.

Scrubbers.

BENCH WORK.

Iron Floors and Roofs, Plate Girders.

Heavy Loam Castings.

HYDRAULIC WORK.

Lamp Posts, Valves, Etc.

ISBELL-PORTER COMPANY,

G. G. PORTER, Prest. (Successors to SMITH & SAYRE MFG. COMPANY) CHAS. W. ISBELL, Secy.

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

Special Castings, Tees, Bends, etc.
Bench Castings.
Water Gas Generators.
Hydraulic Mains.
Iron Floors.
Brenner Self-Sealing Retort Lids.
Tar Gates and Hydraulic Main Dip Regulators.
Hutchison's Tar Displacement Apparatus.
Multitubular Condensers.
Standard Washer-Scrubbers.
Tower Scrubbers.
Walker's Tar and Carbonic Acid Extractors.
Exhausters.
Engines.
Steam Jet Exhausters.
Exhauster Governors.
Compensators.
Self-Acting Bye-Pass Valves.
Valves.
Valve Stands with Indicators.
Purifying Boxes.
Purifier Valve System.
Center Seals.
Street Governors.

Estimates, Drawings and Specifications Furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

ISBELL-PORTER COMPANY,

No. 245 Broadway, New York City.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

JAMES R. FLOYD & SONS,

(SUCCESSORS TO HERRING & FLOYD)

Oregon Iron Works,

W. 20th & 21st. Sts., bet. 10th & 11th Avs.,

NEW YORK CITY.

Engineers and Contractors

FOR THE

CONSTRUCTION OF GAS WORKS.

MANUFACTURERS OF

All Kinds of Castings and General Ironwork

FOR

GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings.

Condensers, Scrubbers, Purifiers, Street Drips and Connections,

Valves,

Hydraulic Hoisting Purifier Carriage, Self-Sealing Retort Lids, Improved Valve Stand and Indicator, Seller's Cement.

Plans, Specifications, and Estimates furnished for Construction of New or Alteration of Old Works.

Bouton Foundry Co.,

FOUNDERS AND MACHINISTS,

CHICAGO, ILL.

Gas Works Apparatus,

PURIFIERS, CONDENSERS,

Bench Work

SPECIALS. LAMP POSTS,

SCRUBBERS,

Iron Roofs and Floors.

Plans and Estimates furnished for new works or extensions of old works.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Prest. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.

STACEY MFG. CO.,

MANUFACTURERS OF

Single and Telescopic Gasholders,

IRON ROOFS, BRIDGES, LAMP POSTS,

Water and Oil Tanks, Coal Elevator Cars,

COKE CRUSHERS, BENCH CASTINGS,

And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works. Rolling Mill Machinery and Heavy Castings a Specialty.

Foundry: 33, 35, 37 & 39 Mill Street.

Wrought Iron Works: 16, 18, 20, 22, 24 & 26 Ramsey Street.

Cincinnati, Ohio.

1842. **DEILY & FOWLER,** 1891

Laurel Iron Works.

Address, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

GASHOLDERS,

Single and Telescopic.

Holders Built 1885 to 1890, Inclusive

Omaha, Neb.
Scranton, Pa. (2d)
Long Island City, N. Y.
Macon, Ga.
York, Pa.
Chester, Pa.
Hazleton, Pa. (2d.)
Staten Island, N. Y.
Saugerties, N. Y.
Clinton, Mass. (Lan. Mills)
Chattanooga, Tenn.
Galveston, Texas. (3d.)
Fort Plain, N. Y.
Brunswick, Ga.
Port Chester, N. Y.
New Rochelle, N. Y.
Salem, N. J. (3d)
Omaha, Neb. (2d)
Lynn, Mass. (2d)
Little Rock, Ark.
Irvington, N. Y.
South Boston, Mass.
Rye, N. Y. (2)
Woodstock, Ont.
Malden, Mass.
Staten Island, N. Y. (2d)
Woodstock, Ont.
Malden, Mass.
Paducah, Ky.
Norwich, Conn.
Seattle, W. T.
San Diego, Cal.
Northern Gas Lt. Co., of New York N. Y.
Westerly, R. I.
Willimantic, Conn
Montclair, N. J.
Attleboro, Mass.
Santa Cruz, Cal.
Erie, Pa. (3d)
West Chester, Pa. (2d
Lancaster, Pa. (3d
Tacony, Pa. (two)
Mount Vernon, N. Y.
Binghamton, N. Y.
Concord, N. H.
Dover, Del. (2d)
Calais, Me.
New London, Conn. (2d)
West Chester, N. Y.
Bay Shore, L. I.
Washington, D. C.
Newport, R. I. (2d)
Morristown, N. J.
Lebanon, Pa.
Oakland, Cal.
Central Gas Lt. Co., New York City (4d)
Tacoma, Wash.
Knoxville, Tenn.
Pottstown, Pa.
Victoria, B. C.
Vancouver, B. C.
Charlottesville, Va.
So. Framingham, Mass.
Woonsocket, R. I.
Simcoe, Can.
Pittsfield, Mass. (2d)
Chattanooga, Tenn. (2d)

PATENTS.

FRANKLIN H. HOUGH

Solicitor of American & Foreign Patents.

925 F. ST., WASHINGTON, D. C.

(NEAR U. S. PATENT OFFICE.)

Personal attention given to the preparation and prosecution of applications for Letters Patent. All business before the U. S. Patent Office attended to for moderate fees. **No Agency in the United States possesses superior facilities for obtaining Patents,** or for ascertaining the patentability of inventions. Copies of patents furnished for 25 cents each. Correspondence solicited.

GREENOUGH'S

"DIGEST OF GAS LAW."

Price, $5.00.

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO., 32 Pine St., N. Y.

WM. HENRY WHITE,

No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.

Plans and Estimates Furnished.

GAS COALS. CANNEL COALS. GAS ENRICHERS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 & 229 Produce Exchange, New York.

Cable Address, "PERKINS, NEW YORK." Post Office Box 3695, New York.

GENERAL SALES AGENTS FOR

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS COAL.

HON. W. L. SCOTT, Prest. M. H. TAYLOR, Vice-Prest.

This Colliery is located at SCOTT HAVEN, PA., in the center of the Youghiogheny Gas Coal District, and produces the ONLY RELIABLE YOUGHIOGHENY COAL for gas purposes. (See Map on p. 87 of this JOURNAL, Feb. 16, '85.)

POINTS OF SHIPMENT,

Locust Point, BALTIMORE. Pier No. 62, PHILADELPHIA.

ST. GEORGE, STATEN ISLAND, N. Y. HARBOR.

Also, Shippers of the following well-known Cannels:

Breckenridge & Old Kentucky Boghead from Kentucky,

AND THE

JELLICO CANNEL, from TENNESSEE.

Within the past four years we have delivered these Cannels to over One Hundred and Fifty Gas Companies in Thirty-five different States, and to some of the largest Gas Companies in

GREAT BRITAIN, ON THE CONTINENT, AND SOUTH AMERICA.

Single carloads or more delivered at any required point in the United States and Canada. Cargo shipments from

NEW YORK, PHILADELPHIA, BALTIMORE, NORFOLK, AND NEWPORT NEWS.

Particulars as to prices, etc., furnished upon application to the above address.

JAMES & WILLIAM WOOD,

Gas and Cannel Coal Contractors,

No. 40 St. Enoch Sq., Glasgow. No. 2 Talbot Court, London.

Proprietors of the **BATHVILLE COLLIERIES** (which produce the celebrated **BOGHEAD CANNEL**), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

STANDARD CANNELS,

Unequaled as Gas Enrichers.

Analyses, prices, and all further information furnished on application to

Agency for U. S., Room 70, Nos. 2 & 4 Stone St., N.Y. City.

Established 1860.

CAESAR BROS.,

MANUFACTURERS OF

ENAMELED

Gas, Water Meter, and Clock

DIALS.

ALSO,

Enameled Iron Plates in Colors, and the Patent Enameled Letters and Numbers.

We make a specialty of this class of work, and, with our long experience of over 30 years, can guarantee not only satisfaction and correctness, but extremely low quotations. ESTIMATES AND SAMPLES FURNISHED ON APPLICATION.

Office & Salesrooms, 11 Park Row, N.Y.

Factory, 153, 155 157, 159 West Avenue, Hunters Point L. I., N. Y.

COKE CRUSHERS.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, Clarksburg, Harrison Co., W. Va.
WHARVES, Locust Point, Baltimore, Md.
OFFICE, 44 South Street, Baltimore, Md

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS. } BANGS & HORTON, 60 Congress St., Boston.

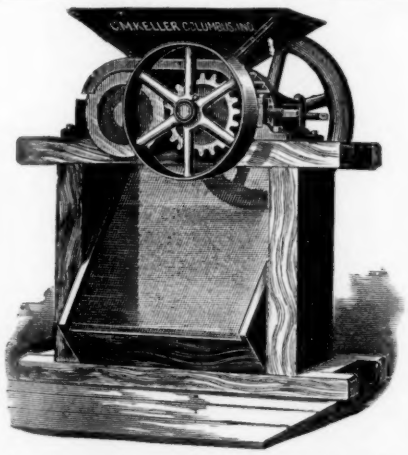
COXE BROS. & CO.

Cross Creek, Sugar Loaf & Beaver Meadow Lehigh Coals.

General Office, 143 Liberty St., New York.

Boston, 70 Kilby Street; Phila., 420 Walnut Street; Chicago, "The Rookery"; Buffalo, Coal and Iron Exchange; Milwaukee, 91 Michigan Street.

E. B. ELY, Gen'l Agent.



Keller's Adjustable Coke Crusher.

SIMPLE, STRONG, AND DURABLE.

C. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. Columbus, Ind.

Correspondence Solicited.

Electric Light Primer.

By CHARLES L. LEVEY.

A simple and comprehensive Digest of all the most important facts connected with the running of the Dynamo and Electric Lights, with Precautions for Safety, etc.

Price, 50 cents.

A. M. CALLENDER & CO., 32 Pine St., N.Y.

GAS COALS.

GAS COALS.

THE PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened & Prepared for Gas Purposes

Their Property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

209 SOUTH THIRD STREET, PHILA., PA.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River: Pier No. 1 (Lower Side), South Amboy, N. J.

Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS,

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

C. B. ORCUTT, General Agent, - - No. 1 Broadway (Room 217) New York City

EDMUND H. McCULLOUGH, Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa

THE CLERK GAS ENGINE CO.,

Main Office, 1012, 1014, 1016, 1018 Filbert St., Philadelphia, Pa.

WM. W. GOODWIN, Prest. E. STEIN, Sec.

The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in running, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time.

Made in Sizes of 5 10, 15, 20, and 25 Horse Power. All Engines Guaranteed for One Year.

JOHN J. GRIFFIN & CO.,

Nos. 1513, 1515, 1517 & 1519 Race Street, PHILADELPHIA.
52 Dey St., NEW YORK. 75 N. Clinton St., (FRED. R. PERSONS, Mangr.) CHICAGO.

MANUFACTURERS OF

METERS FOR MEASURING GAS

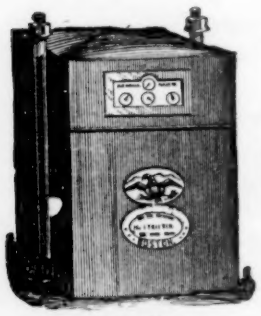
IN ANY VOLUME.

Provers, Gauges, Registers, Etc., Etc.

EXPERIMENTAL APPARATUS FOR QUANTITATIVE AND QUALITATIVE ANALYSIS.

Careful and Prompt Attention paid to Repairing of all kinds of Meters and Apparatus.

Estimates Cheerfully Furnished.



Dry Gas Meters.

With 40 years' experience and the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

No. 153 Franklin Street, Boston, Mass.,

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges. Pressure and Vacuum Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Patent Cluster Lanterns for Street Illumination.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 122 & 124 Michigan St.**
NEW YORK, 838 Broadway. **SAN FRANCISCO, 221 Front St.**
BOSTON, 92 Water Street, Rooms 21 and 22.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Success" and "Perfect" Gas Stoves.

A. HARRIS. E. L. HARRIS. J. A. HARRIS.

Established 1849.

HARRIS BROS. & CO.,

Twelfth and Brown Streets, Philadelphia.

Manufacturers of Wet and Dry Gas Meters,

STATION METERS, METER PROVERS,

EXPERIMENTAL METERS, SHOW OR GLAZED METERS,

Pressure and Vacuum Registers, Gauges, Photometers, Drip and Bell Pumps, Etc., Etc.

PROMPT ATTENTION GIVEN TO ALL ORDERS. METERS THOROUGHLY REPAIRED. ESTIMATES FURNISHED FOR STATION METERS OF ALL SIZES. CORRESPONDENCE SOLICITED.

GAS METERS. GAS METERS. GAS METERS.

GEO. J. McGOURKEY, Prest. WM. H. McFADDEN, Vice-Prest. (Phila.) WM. N. MILSTED, Gen. Supt. and Treas. (New York). WM. H. DOWN, Sec.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

Manufactories:
512 West 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES.
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
177 Elm Street, Cincinnati.
244 & 246 N. Wells Street, Chicago.
810 North Second Street, St. Louis.
222 Sutter Street, San Francisco.

HELME & McILHENNY,

(Established 1848.)

GAS METER MANUFACTURERS,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

WET AND DRY GAS METERS. STATION METERS, EXPERIMENTAL METERS, METER PROVERS,

Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works.

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of **all makers.**

D. McDONALD & CO.,

GAS METER MANUFACTURERS.

(Established 1854.)

151 Lancaster St., Albany, N. Y. 34 & 36 West Monroe St., Chicago, Ill.

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS, PRESSURE GAUGES, ETC.

We use only the very best materials, and employ the most skilled labor, and by our long experience (37 years) and personal supervision of every deta we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the Sta Inspector's BADGE, and will be fully warrented by us. Our Annual and Calendar will be sent to Gas Companies upon application.

Other people have found us to
their advantage.
We'll be glad to serve you.

STATION METERS.
METER PROVERS.
CONSUMERS' METERS
REPAIRING.

W. WALLACE GOODWIN, President. E. STEIN, Vice-President. WM. E. STEEN, Sec. & Treas. H. B. GOODWIN, Superintendent.

THE GOODWIN GAS STOVE AND METER COMPANY,

1012, 1014 & 1016 Filbert Street, Philadelphia, Pa.

113 Chambers St., N. Y. 44 & 46 Dearborn St., Chicago. Agts., Waldo Bros., 88 Water St., Boston.

SOLE MANUFACTURERS OF THE

"Sun Dial" Gas Stoves,

IN A GREAT VARIETY OF STYLES AND SIZES.

Gas Cooking Stove No. 7 C.

The Most Economical, Efficient, and Durable Gas Stove Made.

	SIZE.		
Stove.	*Oven.*	*Broiler.*	*Top.*
31 inches high.	9¼ inches high.	10 inches high.	nches high.
17 inches wide.	15 inches wide.	15 inches wide.	16 inches wide.
	12⅝ inches deep.	12¼ inches deep.	
	Length over extension shelves, 32 inches.		

This Stove has three Boiling Burners in the Top or Hot Plate, and single Oven Burner.

The consumption of this Stove is 35 cubic feet per hour, at 1¼ inch pressure with all burners.

Three-eighth inch supply pipe should be used when the pressure is 1¼ inches or over.

ALL FITTINGS ARE NICKEL PLATED.

Catalogue showing Styles and Prices sent free on application.

DRY and WET GAS METERS

Station Meters (square, cylindrical, or in staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, etc., etc.

METER PROVERS (Sizes 2, 5 and 10 feet.)

Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6 and 9 in.), King's Pressure & Vacuum Gauges.

DRY & WET CENTER SEALS, DRY & WET GOVERNORS, EXHAUSTER GOVERNORS.

Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus Complete.

Also, TESTING AND CHEMICAL APPARATUS OF ALL KINDS, AND OF THE MOST PERFECT DESCRIPTION, FOR ALL PURPOSES RELATING TO GAS.

GOODWIN'S IMPROVED LOWE'S JET PHOTOMETER.

Agents for Bray's Patent Gas Burners and Lanterns.

Special attention to Repairs of Meters and all Apparatus connected with the business. All work guaranteed first-class in every particular. Orders filled promptly.